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BRIDGES—BUILDINGS—CONTRACTING—SIGNALING—TRACK

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CONTENTS.

Renewing Ties to Face.

THERE ARE a good many advantages derived in renewing ties to face. This method would give more uniform wear on all ties since they are subjected to more uniform treatment. When ties are not renewed to face but in spots, the new ties lie on an uncompacted roadbed, and do not carry their full share of loads for some time. During the time the roadbed is being compacted under replacements, the older ties adjacent are subjected to unusually severe mechanical wear, rail cutting, due to the fact that they carry part of the load which should be sustained by the new ties.

Once the roadbed does become compacted, the new ties begin to be subjected to more than their share of the load, due to the fact that they compress and give little when the load comes on them. The old ties are softer and give more as the load passes over. Thus after the roadbed is again compacted, if both the old tie and the new tie are tamped up solidly, and bear tightly against the rail, the new ties will be subjected to unequal and greater rail wear. Thus it would seem that spotty tie replacing produces greater mechanical wear on both the old and new ties, than if the load was constantly taken uniformly by each tie at all times.

If the wheel loads are not carried uniformly by each tie the load transferred or supported by the ballast underneath the ties will not be uniform, which will, of course, tend to produce poor or uneven surface. This condition will be still further aggravated if the ballast is not sufficiently thick to distribute the load evenly over the subgrade. And if the load is transmitted unevenly to the ballast in the first place, will it not take a greater depth of ballast to obtain even distribution of pressure on the subgrade?

Among the arguments that may be brought against renewing ties to face are: It shortens the life of the tie; the loosening up of the whole roadbed at one time may give a tendency towards excessive wave motion in the track, causing creeping.

Ties which must be removed from a track, will many times be found unfit for further use, while if they were not disturbed a further life of a year or two might be obtained. The pulling of the spikes may leave the tie almost unfit for further service. When making track changes it is always advisable to line tracks to their new position (within reasonable distances), rather than to tear up and rebuild them, for the above reason; that is, to avoid discarding a large percentage of the old ties. However, these ties which could be used in side tracks again, from main line renewed to face, could be left in the side track some time after their condition would be such as to necessitate their removal from main track. This, naturally, because the side tracks are not used so often or subjected to anywhere near the high speeds of the main track. The ties in a side track are, possibly, more affected by decay than main track ties. The latter are subjected to greater mechanical wear. By the method of renewing ties to face and using some of them first in the main and later in the side track, a partial balance of these two destructive agencies may be obtained.

As to a greater tendency to creeping, we are not assured that such will be the case in track where the ties are re-

newed all at the same time: This tendency, if present, would soon disappear, as only a small depth of ballast would need to be compacted. On the other hand, we believe that in spotty renewals increased wave motion and consequent creeping is liable to result through the uneven pressures induced.

When rails are relayed, the work is carried on over a long stretch of track. Practically nowhere will you find that a few scattered rails are replaced each year. Such a policy would be instantly condemned. A new rail placed next to old rails will soon be spoiled by battering at the joints. Something of the same effect occurs when ties are renewed in spots.

Rails, it may be said, are made of steel, are more uniform in structure and they wear practically the same length of time. This is undoubtedly true, although there is still much to be desired in the composition of steel rails. When renewing ties to face, therefore, it would be advisable to exercise care to select ties of the same timber, uniform grade, etc., as far as possible, so as to obtain the greatest length of life of all the ties in the main track.

Wood Preservers' Association.

THE PRESENT era in railway, as in most every other kind of construction, is tending toward greater stability and permanence. We find numerous instances of this. The government, as well as a number of associations, are working for the more universal use of permanent and fireproof construction. Manufacturers of sheet steel and similar products have been working to produce metals which resist corrosion in exposed places. Rail-makers are experimenting with different alloys, tending to make rails stronger, more durable, and more uniform of texture, all of these things tending towards greater permanence and safety. The enormous increase in concrete construction comes partly because of its great resistance to fire. And in building trestles, arches, culverts, viaducts, etc., of concrete, railways are making their structures more permanent and fireproof.

All of these materials have been used to take the place of wood, and under most circumstances any of them are more durable. For a great many purposes, however, none of these materials have been developed in such a manner as to fulfill all the uses for wood. And in many places, the use of wood is still deemed advisable where other more permanent construction could be used, but is more expensive. There is at least one case in which wood is still conceded to be the best construction material, and that is for the railway cross tie. In timber construction we see the leaning toward more permanent structures expressed by the great growth of the wood preserving industry.

The Wood Preservers' Association is interested in the general proposition of wood preservation. But since over two-thirds of the wood treated with preservatives in the United States is cross ties, it will be seen that the problem of tie preservation is by far the most important one with which this association deals.

The first meeting of this association was held in 1905. The attendance at the fifth annual convention was exceptionally large, considering the number of members. The interest of those present was manifested by discussions which were telling and to the point. A remarkable growth in membership was reported by the secretary, and this association promises to continue to increase in prominence and importance.

An Explanation.

UNDER THE heading, "Maintenance of Roadway and Track," on page 517 of the November, 1911, issue, we published an article which in good faith was credited to a bulletin published by the Bureau of Education of the Chicago Great Western R. R. It has been called to our attention that this matter was originated by the Bureau of Education of the Union Pacific R. R., and should, of course, have been credited to the latter. The Union Pacific has perhaps progressed farther than any other railway in the work of supplying its employes with the means of educating themselves for better positions, and of raising the standard of their efficiency. The article referred to is the major part of only one lesson on the subject of maintenance of track. The thoroughness with which this subject was treated is typical of the class of work being done for each department of the system's operation.

Just About a Clock.

ALTHOUGH aeroplaning cannot as yet be called a common means of intra-urban or local transportation, the architects for the recently completed Chicago and Northwestern passenger terminal in Chicago, showed great wisdom in placing the main tower clock where it can be observed by aviators in approaching the station. There are a few fault finders, however, who have taken a very short sighted view of the situation. These people persist in the argument that, although the present location of the clock is such as to make it particularly useful to future aviators, some assistance should be given those who for the present at least are constrained to approach the station via the terra firma route. Past experience tells us that such illogical chronic kickers cannot be satisfied with simple explanations and it is therefore suggested that if the main tower clock in question cannot be moved into a position observable from the street, one or more auxiliary clocks be placed in such position. It might be economy, in case such action is taken, to stop the large clock and thus save the wear on its works until the use for which it was intended becomes existent.

Under a new German process concrete poles and piles are made by pouring concrete into forms which lie within a long turning lathe, the lathe then being revolved by electricity at the rate of 800 revolutions per minute. Within ten minutes the concrete has set sufficiently to retain its form and is then placed under drying sheds for two or three weeks to thoroughly season, after which it is ready for use.

A plant has been established at Los Angeles for manufacturing piles by this process, for which the machinery has been ordered from Germany and is expected to arrive in about six weeks. It is expected that several of these plants will be in operation in this country within a few years.

Celilo Bridge, Oregon Trunk Ry.

By H. M. Harps, Resident Engineer.

The Oregon Trunk Railway, a Hill line into central Oregon, runs from the junction with the Spokane, Portland & Seattle Railway, at Fallbridge, Washington, 156.5 miles to Bend, Oregon. The railway crosses the Columbia river at the Celilo Falls, which are three-fourths of a mile west of the new station of Fallbridge, and eleven miles east of The Dalles, Oregon. The line crosses the river at nearly 90 degrees, although all the piers from pier 1, north, except pier 19-E., have a skew with the main bridge tangent of 4 ft. in 18 ft. The track is tangent over all of the through truss spans, separating at the north end into a wye, both legs of which are on an 8 degree curve and connect with the S. P. & S. Ry. The girders of the south approach, which cross over a highway, the O. W. R. & N. Ry., and the State Portage Railway, are on a 7 degree 30 minute curve. The grade rises to the south, varying from 0.217 degrees to 0.5 degrees, the track at the south end being 13.63 ft. higher than at the north end.

All of the piers north from pier I are founded on exposed, basaltic rock, the excavations for footings being about 3 ft. deep, except in a few special cases. The foundation for pier IV, which is located on an island in the main low water channel of the river, was excavated at low water through about 12 ft. of rock, as there was an open seam across the whole island above this level. The foundations for piers 1 and 11, which are on the sides of the Government canal, were carried through solid rock nearly to the bottom of the canal, as the heavy shooting for the canal excavation had shattered the rock badly. South abutment "A" and piers B, C, D, & E, were carried to solid rock through earth excavations.

The river channel between piers III and IV has never been sounded, but it is probably 100 ft. deep. The current is very swift at this point and the sides of the channel very nearly perpendicular. Pier III is located as close to the channel as it is possible to get it. In order to be sure that the rock was not overhanging under the foundations of piers III and IV, four diamond drill holes were sunk to a depth of 200 ft. One hole was drilled north of pier III as close to the channel as possible and three were drilled on the island around pier IV. The size of core of these holes was 1 3-16 in. in diameter for the first 75 ft. and 7-8 in. in diameter for the next 125 ft.

The piers were built during low water when all of the foundation beds were dry. At high water the foundations from pier I north, are all submerged. The rise in the river at pier IX is about 50 ft. from low water to ordinary high water. During low water the river flows through four channels: one under span VIII, one under span IX and the others under spans III and IV. These last two channels are really one main channel at the south bank of the river, divided into two parts at the bridge crossing by the island on which pier IV is built. At ordinary high water the river is about 2,700 ft. wide.

Substructure.

The substructure consists of 29 piers and three abutments. The south abutment is of concrete with granite bridge seat. Piers B, C, D, & E are of concrete with granite coping and belting courses. These four piers have semi-circular ends, are 6 ft. thick under the belting course and 8 ft. wide on top, the belting and coping each overhanging 6 in. Fig. 1 shows pier B just after completion. The temporary tramway has been almost entirely removed, a little of that structure still showing between piers A and B. An the south side of the river, the tramway was built on a high level, passing over the tops of the finished piers.

Piers I, and V to X inclusive, are 8 ft. 6 in. thick under the belting and 10 ft. 6 in. wide on top. The length is 24 ft. between shoulders where the nose begins, which is formed by two intersecting circular arcs. These piers are of concrete with granite nose stones, coping and belting courses. Piers III and IV are 10 ft. thick under the belting and 12 ft. wide on top; otherwise they are the same as the piers above mentioned. Pier II, the pivot pier of the swing span, is octagonal in shape, inscribed in a 30 ft. square. It is built of concrete with granite nose stones on the eight corners and granite around the outside of the coping course.

Constructing the Last Span of the Celilo Bridge, Oregon Trunk Ry.

The piers for the north approach girders, from pier XI north are 6 ft. thick under the belting with a coping 8 ft. wide. These piers all have granite nose stones, belting and coping courses. The length is 14 ft. between shoulders, excepting piers XI and XII, which are longer on account of the girders fanning at this point. The nose of the two spans is formed by intersecting circular arcs as on the other piers described. The east and west abutments of the north approach are of concrete with granite bridge seats and nose stones.

Fig 2 is a panorama view showing the temporary track layout. Most of the temporary tramway had been taken down, but a portion still remains along the west leg of the wye and out as far as pier VIII. The three derricks shown are located along the east leg of the wye, working on the piers.

All the piers have 1 in. square Johnson bars placed vertical, 2 ft. center to center, 6 ft. from the surface. All the piers have a batter of ½ in. to the foot. The granite nose stones mentioned, consist of one stone on both the up and down stream ends of the piers, for the full height, of the size and shape shown in the following sketch: Most of the concrete was of 1:2½:5 mixture.

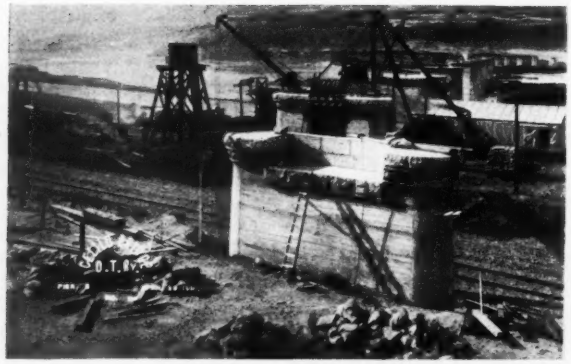


Fig. 1.—Pier B Completed.

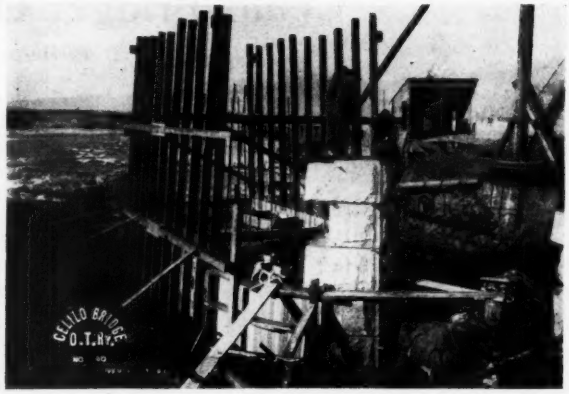


Fig. 4.—Pier 5, Showing Placing of Nose Stones, and Forms for Concrete.

Fig. 4 shows the nose stones being placed on pier IV and forms being built up overlapping the nose stones. The Johnson reinforcing bars used in the concrete are shown in place. The nose stones are being drilled for the dowel pins.

The substructure work was handled by two separate organizations, the force on the north side of the river doing all the work out to and including pier IV. This work was handled as follows: The gravel and most of the sand used for the concrete was obtained from a bank just north of the S. P. & S. Ry. track about 300 ft. from the west abutment.

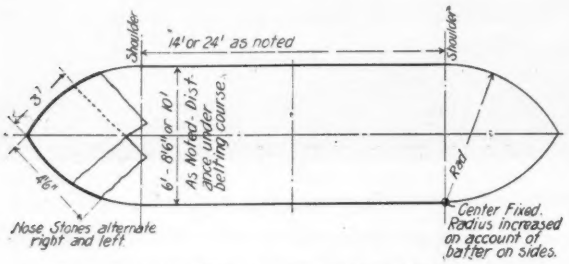


Fig. 3.—Detail of Granite Ness Stones.

The material was brought to an endless chain bucket elevator by wheel scrapers, elevated to the screens, washed when necessary, and the separated sand and gravel conveyed in push cars, on a tramway over the S. P. & S. track, and dumped into the bins just above the mixer. The mixer was located just west of the west abutment and the cement, sand and stone fed by gravity into a hopper which held material for one batch, and then into the mixer. From the mixer a double track tramway extended along the west leg of the wye out to pier IX. One track being standard gauge for the use of the derrick car which handled the concrete buckets, stone noses, coping and belting. The other track was narrow gauge for the use of concrete cars only, which were hauled by a dinky engine. Beyond pier IX the tramway was built to carry only the narrow gauge material track; the material for piers IV to VIII being handled by stiff legged derricks. This material tramway was extended as far as the channel north of pier IV, and crossed four wide channels over which it was necessary to use truss stringers. Over the widest of these openings two 9"x18"x70' timbers were used under each rail, trussed with cables.

Pier IV was built by a derrick having the mast and one of the stiff legs on the island, and the other stiff leg reaching across the channel. A 90 ft. truss boom was used, which reached across the channel for the material delivered at the end of the tramway.

The piers on the east leg of the wye were built by stiff legged derricks set up so that each derrick could handle two piers; the material being delivered by concrete cars, on a track laid on the surface, or a low tramway where it was required.

The concreting was done in lifts the height of three nose stones; that is, three nose stones were set at each end of the pier, the forms built and the concrete placed in one pier while the nose stones were being set for another pier. This single nose stone is probably a unique feature for these piers and makes the form work quite complicated as the stone extends only part way round on the circular arc of the nose,

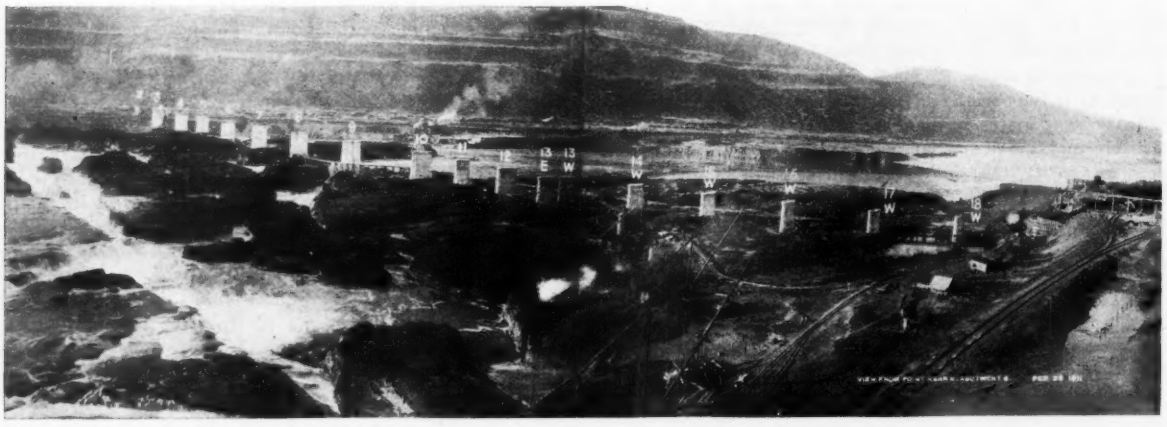
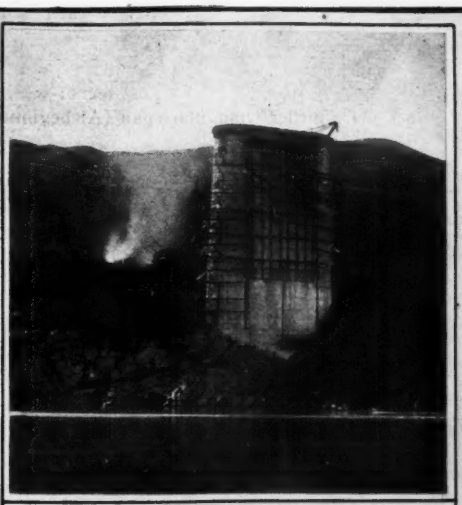
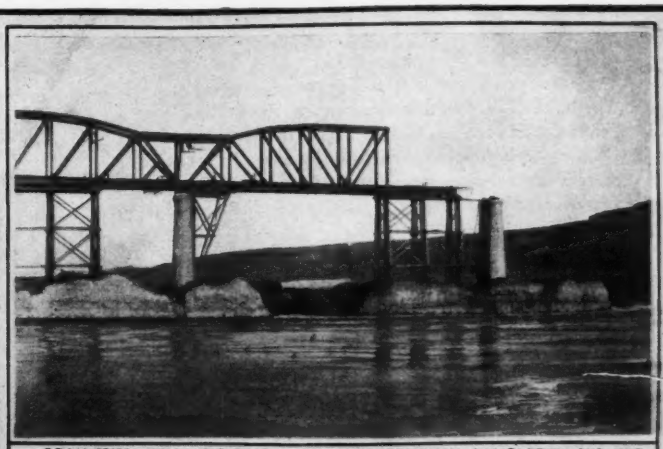


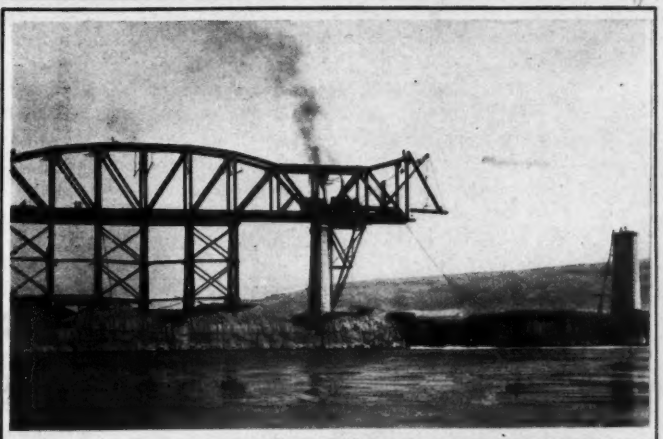
Fig. 2.—Panoramic Construction View, Showing Part of Elevated Tramway, and Construction Tracks.



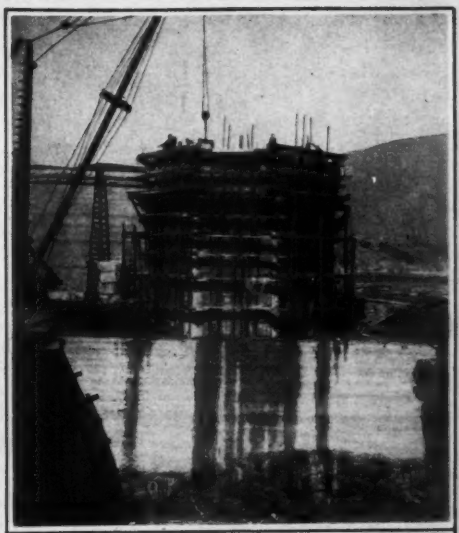
PIER III AT EXTREMELY LOW WATER, AT WHICH STAGE THE PIER WAS CONSTRUCTED. IN ORDER TO TEST THE STABILITY OF THE FOUNDATION BED, A DIAMOND DRILL HOLE WAS SUNK BETWEEN THE PIER AND THE RIM. THIS TEST SHOWED THAT THE BED WAS NOT UNDERMINED



SPAN VIII, SHOWING THE CANTILEVER ERECTION COMPLETED AND THE TRUSSES LANDED ON FALSEWORK UNDER THE FIFTH PANEL POINT. THE STRINGERS FOR THE NEXT TWO PANELS ARE IN POSITION ON THE FALSE WORK

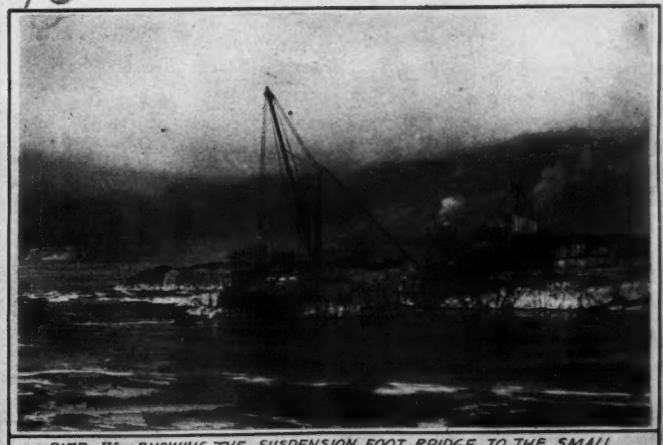


SPAN IX ERECTED. SPAN VIII IS BEING ERECTED. CANTILEVER WEDGES WERE LOCATED AT THE CENTER OF THE TWO PIECE TIE BACKS, WITH LEVERS BY WHICH THE WEDGES WERE SCREWED DOWN TO SHORTEN THE TIES AND ADJUST THE END OF CANTILEVER SECTION TO THE HEIGHT DESIRED



PIER II THE OCTAGONAL PIVOT PIER OF THE SWING SPAN WITH THE CONCRETE FORMS STILL IN PLACE. THE THE FACE OF THE FOOTING IS THE SIDE OF THE UNITED STATES GOVERNMENT CANAL. PIER III SHOWS IN THE BACKGROUND

CONCRETE PLANT ON THE NORTH SIDE OF THE RIVER. THE SAND, STONE AND CEMENT WERE DELIVERED TO THE BINS THROUGH A CHUTE, FROM A PUSH CAR. THE ELEVATED TRAMCAR LED TO THE SCREENS WHERE SAND & STONE WERE SEPD



PIER IV, SHOWING THE SUSPENSION FOOT BRIDGE TO THE SMALL ISLAND ON WHICH THE PIER IS LOCATED. THE DERRICK IN THE FOREGROUND IS PLACING CONCRETE, DELIVERED TO IT AT THE END OF THE TRAMWAY.

as shown by the sketch. The nose stones were doweled into the concrete and to each other.

The thickness of the nose stones was 2 ft. 6 in. for all except a few courses at the top, which were gradually made thinner for the sake of a better appearance, the belting course being 18 in. and the coping course 24 in. thick. Nose forms were built for the height of three stones with different radii to fit the pier at various elevations. Some of these forms were made of 2"x2" material and others of 1"x3", as shown in the illustration.

On the south side of the river the mixer was located, just west of pier E, and the concrete elevated by a stiff legged derrick to a tramway which ran over the tops of piers B, C, D and the south abutment. The concrete for the piers was dumped from cars on the tramway into chutes. The derrick which elevated the concrete for these piers was so placed that it could handle the material for piers E and I. Piers II and III were built with a stiff legged derrick. Basaltic rock taken from the government canal and crushed by a plant located near the bridge site, was used for the concrete on the south side. Excavation for the piers began on July 19, 1910. The first concrete was placed Sept. 15, 1910, and the last coping stone was set May 1, 1911.

The work was carried on continuously all through the winter, the weather conditions being extremely favorable, there being only two or three days when concreting had to be stopped as no special attempt had been made to provide for

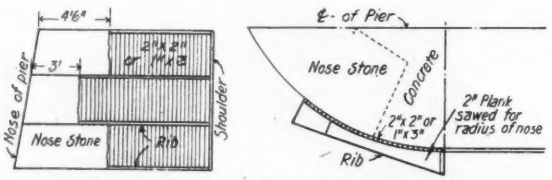


Fig. 5.—Detail of Form Work Around Nose Stones.

extreme cold. Steam pipes were run into the water barrels and also through the sand and stone bins and these heated the materials enough to permit concreting at freezing point or a few degrees below.

The quantities in the substructure are as follows:

Dry earth excavation	1,734 cubic yards
Wet earth excavation	202 cubic yards
Solid rock excavation	5,388 cubic yards
Loose rock excavation	1,321 cubic yards
Concrete	19,226 cubic yards
Granite nose stones	1,327 cubic yards
Granite in coping and belting courses	920 cubic yards
Steel reinforcing bars in concrete	171,200 pounds

The height of the piers varies from 34 ft. to 52 ft., under the girder spans, and from 57 ft. to 82 ft. for the piers which support the truss spans. Pier IV is the highest pier, being 82 ft. from the foundation to the top.

At low water pier VIII is situated on a small island, piers V, VI and VII on a large island, and pier IV on a small island in the middle of the main channel. In order to get to these pier sites, before the material tramway was erected, the contractor built a stringer foot bridge across the channel south of pier IX and wire cable suspension foot bridges across the channel south of pier VIII and the channel between piers IV and V. These bridges were to enable the workmen to get to the pier sites to make excavations.

Porter Bros., of Spokane and Portland, were the contractors for the substructure.

Superstructure.

On the north approach the superstructure consists of deck plate girder spans on both the east and west legs of the wye. The south approach also consists of girders, while the central spans are curved chord trusses. The number and length of spans is as follows:

Seven 100 ft. deck plate girder spans. East leg of wye.
One 97 ft. 5 in. deck plate girder span. East leg of wye.
Seven 100 ft. deck plate girder spans. West leg of wye.
One 100 ft. deck plate girder triangular span (At beginning of wye).
One 100 ft. deck plate girder span.
Six 227 ft. through truss spans, riveted.
One 316 ft. 8 in. through truss span, pin connected.
One 246 ft. 8 in. through swing span, riveted.
Two 72 ft. 9 in. deck plate girder spans (south approach).
One 72 ft. 6 in. through plate girder span, over the State Portage Ry.
One 73 ft. 9 in. through plate girder span, over the O. W. R. & N. Ry.
One 75 ft. 4 in. deck plate girder span.

The south arm of the swing span crosses the United States government canal which is being built around the Celilo Falls and the many rapids between Celilo and The Dalles. Piers I and II are built directly on the edge of the canal, which fixes the length of this arm at 123 ft. 8 in. divided into four panels of 30 ft. 11 in. The north arm is 105 ft. long—four panels at 26 ft. 3 in. The tower panel is 18 ft. Pier III is placed as near the channel as possible. The swing span is counterbalanced by placing 27,000 pounds in the north end panel.

The girders were erected with a derrick car of 40 tons capacity, built up of two 100,000 pound steel flat cars with a 70 ft. fixed boom. The timbers on the floor of the cars taking the horizontal thrust had a butt joint near the space between the two cars with curved bearings to permit the cars to pass around the 8 degree curve.

In erecting the west leg of the wye the girders were delivered to the derrick (headed south), close to the foot of the piers. These girders were delivered on flat cars, on a temporary track on the surface of the ground. In erecting the girders of the east leg of the wye, the derrick car was turned around, heading to the north and the girders were delivered to it over the deck of the west leg of the wye at the junction. The girder was held suspended while the derrick was pushed ahead around the 8 degree curve till the girder could be placed in position. The mast and boom of the car were securely guyed to eye bolts in the rocks below before the boom was swung off center line to set a girder.

The six 227 ft. spans and the swing span were erected on falsework, except across the low water channels under spans VII and VIII. Span VIII was erected as a cantilever over the channel for five panels, at which point a bent of falsework could be placed.

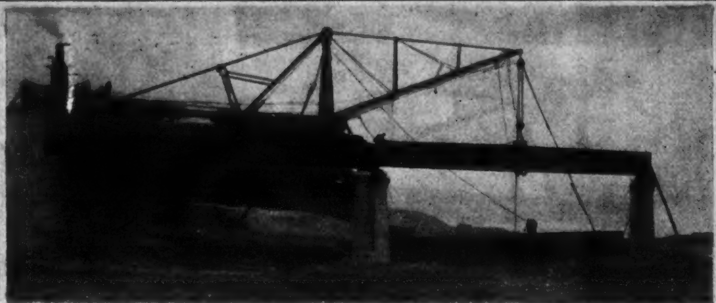
A triangular frame of falsework was set just south of pier IX, on which to rest the first section of bottom chord and the first vertical post and end post, until the tie backs could be erected between the hip joints. These tie backs were built-up sections of plates and angles, each web being slipped over a pin at the hip joint and connected by tie plates which were bolted on.

The erection of span VII started in the same way, although it was only necessary to erect this four panels cantilever before a footing could be obtained for a bent of falsework. The tie backs between the hip joints were made so that one end fitted inside the other at the center with a wedge at this point for adjustment. The thrust at the bottom was taken care of by solid blocking between the ends of the bottom chords.

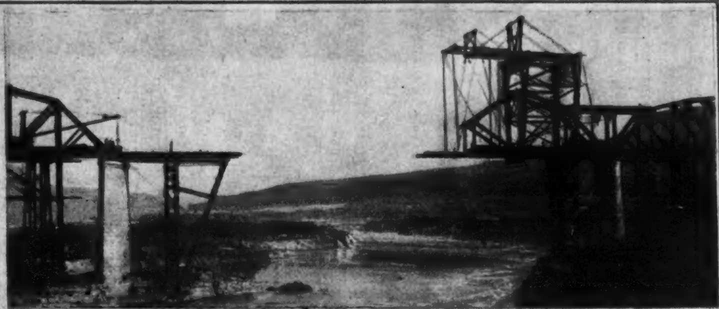
In spans VII, VIII, and IX the derrick car which erected the steel also raised the falsework. In the next three spans, however, a mule was built which ran on the falsework and raised it ahead of the steel.

RAILWAY ENGINEERING AND MAINTENANCE OF WAY.

PANARAMIC VIEW AT HIGH WATER SHOWING WEST LEG OF WYE COMPLETED. AND THE PIERS OF THE EAST LEG COMPLETED AS FAR AS PIER 18. THE BRIDGE SHOES ARE SEEN IN PLACE ON THE COMPLETED PIERS OF THE EAST LEG OF THE WYE



PLACING GIRDER SPAN XVII WEST. THE FIRST GIRDER IS JUST BEING LOWERED TO ITS BEARING. THE SECOND GIRDER LAYS AT THE FOOT OF THE PIERS WHERE IT WAS UNLOADED FROM CARS SPOTTED ON THE TEMPORARY SURFACE TRACKS



TRAVELER ERECTING SOUTH HALF OF SPAN III, AND THE ERECTION TIE BACKS USED IN CONSTRUCTION. SHOWS METHOD OF SUPPORTING TWO PANELS FROM A SINGLE POINT BY ERECTING AN INCLINED MEMBER WITH BRACES TO THE MAIN MEMBERS.

"MULE" PRECEDING THE DERRICK, AND ERECTING THE FALSEWORK FOR SPAN V. THE DERRICK IS RAISING THE CENTER SECTION OF THE TOP CHORD, SPAN VI, INTO PLACE.

FALSE WORK USED IN ERECTING THE SWING SPAN. PIER II IS THE CENTRAL PIVOT PIER OF THE SWING SPAN, BEING OCTAGONAL IN FORM, WITH MASONRY CORNERS BACKED BY CONCRETE. END PIERS I & III ARE OF THE SAME TYPE AS OTHERS IN THIS STRUCTURE.

Span III was erected cantilever from both ends as it was impossible to use falsework in the deep channel. The wedges used in adjusting the length of the tie backs between the hip joints of span III and the anchor spans were the same as had been previously used for the erection of spans VII and VIII. The bottom thrust at pier III, the fixed end, was provided for by solid bearings between the bottom chords. At pier IV, the expansion end, an adjustable wedge bearing was provided for the horizontal thrust, so that the bottom chord could be blocked out far enough to insure the eye bars meeting at the center. The south half of span III was erected with a two bent traveler, running along the track on the outside of the truss; this track was laid on timber stringers which were carried on the projecting ends of temporary floor beams suspended from the truss pins by rods passing through saddle blocks. The north half of span III was erected with a derrick car, and much better time was made than if the traveler had been taken down and erected again on the north side. A double bent of falsework was erected under the first panel point on the south side to support the steel which it was necessary to have in place before the erection ties could be placed. On the north side a double bent of falsework was placed under the first panel point, with an inclined bent from the foot of this bent to the second panel point.

The bridge deck consists of 8"x12" ties on the girder spans and 8"x10" ties on the truss spans, hook bolted to every third tie with 10"x10" guard timbers bolted to every third tie. The inside guard rail is a 4x5x5-8 angle bolted to every tie. Every fourth tie on the north approach girders projects beyond the guard timber on both sides to support two 2"x12" sidewalk planks. A 6"x6" guard timber runs along the ends of the sidewalk ties. A ⅝" diameter galvanized iron rope hand railing passes through an eye in a stanchion bolted to every other long tie. The 10"x10" guard timber was ordered in 24 ft. to 28 ft. lengths and sprung to the radius of the 8 degree curve.

The only life lost on the construction of the bridge was that of a carpenter employed on the substructure, who fell from the truss stringer span into the channel south of pier IX.

On the erection the most serious accident was that to a man who fell from the derrick car on the west leg of the wye, into a small pool of water, a distance of about 45 ft. This was the only body of water within a long distance either side, and cushioned his fall so that he was not seriously hurt and was able to be at work again in three or four weeks.

The total amount of steel in the superstructure is approximately 4,900 tons.

Erection was started on May 11, 1911. Span III, the last one erected, was connected on Dec. 19, 1911. The steel was fabricated by the Pennsylvania Steel Co., and the erection was done by the Missouri Valley Bridge & Iron Co.

General Notes.

For laying out the piers a triangulation survey was made, with a base line on each side of the river, using the main bridge tangent for one side of the quadrilateral. From the triangulation points at the ends of this bridge tangent, the line was accurately measured as far as it was possible to go, on account of the channels, that is as far as pier IX on the north side and as far as pier I on the south side. Measurements on the rocks on the north side were made between copper nail points cemented into a hole drilled into the rock on the high points between which a 100 ft. steel tape was stretched. The piers on both legs of the wye and on the curve at the south approach were located by ordinates from this line. The remaining piers were located by angles from one of the triangulation stations.

The lengths along the center line of the bridge are as follows:

South abutment to beginning of wye	2396.11 ft.
Beginning of wye to west abutment	849.05 ft.
Beginning of wye to east abutment	952.01 ft.
South abutment to west abutment	3245.16 ft.
South abutment ot east abutment	3348.12 ft.
Total length of track on bridge	4197.17 ft.

The six spans from pier IV to pier X were made equal length in order to simplify the fabrication of the steel. The piers were located in the Chicago office on a contour map. When the piers were laid out on the ground, pier IX came just to the edge of the deep low water channel, while, the nose of pier VI projected over a deep ravine which is dry at

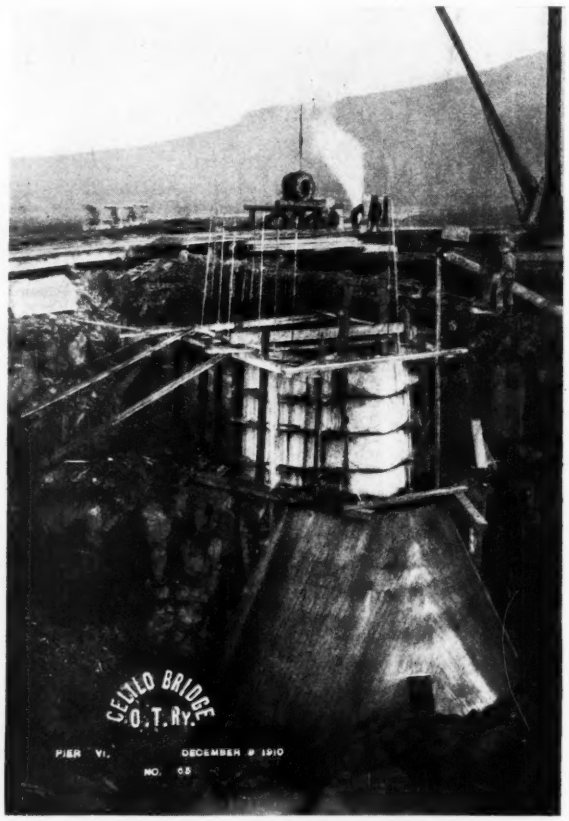


Fig. 6.—Pier VI, Showing Buttress Built Against the Side of the Ravine, to Support the Overhanging Nose Stones.

low water. As a foundation for this overhanging nose, a buttress was built on the side of this chasm.

The granite nose stones, coping and belting stones were handled in the stone yard by a traveler running on framed bents which spanned several tracks.

During the construction of the Oregon Trunk Railway a ferry has been maintained across the Columbia river, at the mouth of the Des Chutes river, about two and a half miles east of the bridge crossing. All the construction material was transported across the river at this point, and since the completion of the road up to the river, passengers have also been transferred here.

The special train of President Carl R. Grey of the S. P. & S. Ry., was the first train to cross the bridge, on Jan. 5, and regular service was established on the next day, when the ferry was abandoned.

The location of the bridge is extremely unfavorable for

erection on account of the high winds, which blow for a large part of the time, the velocity being as high as 75 miles an hour. While erecting the 100 ft. girders, which weigh about 33½ tons, the time required for erection was nearly doubled on account of the high winds.

The bridge was designed by and the construction was in charge of Mr. Ralph Modjeski, consulting engineer, Monadnock building, Chicago. Ill., acting as chief engineer of the Oregon Trunk Railway, with Mr. H. M. Harps, as resident engineer of construction.

A SNEAK ADVERTISER.

The following, which is taken from the *Lumber Review*, seems applicable to other fields as well as that of the lumber trade. It might be stated, however, that the write-ups referred to are sometimes of real news value to subscribers, in which case it would be an injustice to the readers to turn it down for business reasons. It is, therefore, difficult to draw a line of rigid definition. Reading notices in *Railway Engineering and Maintenance of Way* cannot be purchased, but will be published free if of real news value in the opinion of the editors.

"The advertising schools throughout the country are turning out some very bright advertising men. These men usually get positions under some other advertising man in some large department store or manufacturing establishment, and are polished up until they become shrewd and wise in their profession. They secure positions with some of the large houses that believe in advertising, and make money for their employer through this department.

Many of them, however, are not satisfied with a legitimate way of getting their employer's business from the public, but use means that they ought to be ashamed of. For instance, we once received a letter from one of the largest concerns in the United States which is interested in putting out something to assist the office force in the complete business system. With this letter the advertising man attaches a write-up and sends us under separate cover an electrotype. He says, "We would like to have this inserted in your publication as a free reading notice and we are enclosing a copy of the folder for your approval which, after reading, we know you will appreciate as a valuable book for all lumbermen." Then he adds. "Kindly let us have two copies of the edition which contains this reading notice:"

We wrote this advertising man as follows:

"Dear Sir:—We have your letter of February 20. Also the little article that you request us to print and the cut that goes with it.

"We appreciate the fact that as an advertising man employed on salary, you must do the best you can for your employer and we presume that in sending out this cut and this nice little write-up, you will catch some suckers.

"Our paper goes to a good many thousand subscribers throughout the United States. We have a splendid circulation among the mills on the Pacific coast, also in the South and among the retail lumber dealers throughout the country. All the money we get to run our paper comes from our advertising, as it costs us as much for keeping up our subscription list and printing our paper as we get from our subscribers, and if it will do your people any good to come into our paper they are certainly well able to pay for it.

"We shall be glad to either give them written notice or display ad at our regular rates. Yours very truly,

"THE LUMBER REVIEW."

This is what we call sneak advertising. This advertising man appreciates the fact that all reading notices which he can get in a trade paper, especially an illustrated reading notice in a trade paper that has a large circulation, he is going to get something that he can go to his employer and say, "See what I have done for you. I have secured a reading notice in this paper that would have cost you a good many dollars if you had gone after it in the regular way." He knows these trade papers are good publications for his advertising, but is too contemptible to go at the matter in a legitimate manner and pay for what he gets. In order to get a few notices, and he will get a few from some who do not realize the enormity of this man's crime against trade papers, he will have to spend as much money in electrotypes, preparation of reading notices and postage as it would cost to pay one good legitimate trade paper in each line for either a display ad or a reading notice.

We had a very good customer at one time in the lumber business in Ohio who was advertising with us and had been for two or three years. All at once he cut out his ad. He had hired an advertising manager. This advertising manager wrote us that they had decided to change their method of advertising and were cutting out their ads in the trade papers. About two months after we received this letter we received another from this advertising man with about a column and a half write-up. This second letter told us that they had prepared, after a good deal of thought, an article which would be of great interest to our subscribers and that we could have this article without any cost, and they would be pleased to have an extra copy or two of the paper in which it was printed. We read the article over and it was a very beautiful advertisement from this company who had decided that they had no further use for trade papers.

Trade papers, or the publishers of them, should be friendly to advertising men, but they cannot possibly be friendly with this class of advertising men, who cannot be called anything but sneaks. They might just as well steal money out of our pockets as to steal our business.

Advertising has come to be a great business and every one knows, who is in business today, that it is the man who tells what he has to sell that sells it, but every trade paper in the country should beware of the sneak advertising man, and were it not that we do not want to advertise the business of these people in any way, we would print their names every time they send in a proposition of this kind.

At all events, if any of the advertising magazines in the country will take up this matter and can use these names to the advantage of the trade paper and publisher generally, we would be glad to furnish the names of those who come to us with this kind of a sneaky proposition.

A man who makes a business of selling some kind of a patent medicine once told me that he got out electrotypes by the hundred and sent them to the country papers. He said he found it was a paying proposition because they were always short of fillers, and put these in to fill up. As trade paper men we should not put ourselves in with the same school of suckers that this man was fishing for.

The Chicago, Milwaukee & St. Paul according to advices is planning the construction of a bridge over the proposed West Fork Drainage Ditch southeast of Hornick, Ia. The cost of the structure as proposed, will be about $16,500.

The Chicago, Milwaukee & St. Paul proposes to enlarge its roundhouse and install a mechanical coaling station at Perry, Ia.

The Chicago, Rock Island & Pacific, and Union Pacific wil reconstruct a viaduct at Eleventh street Omaha, Neb.

Plans have been prepared by the El Paso & Southwestern for an 8-track yard, roundhouse, repair shops, freight warehouse, office building and passenger station at Tucson, Ariz.

The Erie R. R. has purchased a large tract of land at Kenwood, near Akron, O., on which to erect car shops.

The International & Great Northern is building a new $35,000 passenger station at Laredo, Tex.

It is reported that the Kansas City Southern will build a new roundhouse and shop at De Quincy, Ia.

The Delaware Lackawanna, & Western is receiving bids on a new bridge 1,800 feet long. The bridge will contain about 600 tons of structural steel, several thousand tons of reinforcing bars and will have ten spans. Construction will be almost entirely concrete.

Wood Preservers' Association Eighth Annual Meeting.

The eighth convention of the Wood Preservers' Association was held at Hotel Sherman, Chicago, January 16, 17 and 18. There was a large attendance at the opening session, but this attendance was greatly increased the second day. A large attendance of non-members proves the interest being taken in the work of this association. The papers presented showed careful and competent preparation, and the discussions were usually terse and to the point. The meeting was a success from every point of view, and is especially to be commented on because the Association was formed so recently.

The meeting was opened by Mr. John T. Logan, president, who gave a short talk. Following this the roll of members was called in accordance with the custom. The

E. A. STERLING,
Forester, Pennsylvania R. R.,
President.

secretary, F. J. Angier, read the report for the year, which report was accepted unanimously by the members present. Papers were presented and discussed in the following order.

The Production of the Wooden Cross Tie.

By A. R. Joyce.

Statistics prepared by the Forestry Service of the United States show that of the 125,000,000 cross ties bought by the railroads last year almost 80 per cent were hewed ties. In considering the production of the wooden cross tie, therefore, the hewed tie should absorb most of our attention.

The sawed tie, while occasionally produced by mills built particularly for the sawing of ties, is more generally a by-product of general lumber operations. The best board cuts are taken from the side of the logs, and when these are taken off the heart is boxed into ties and cut off to standard lengths. Small logs are also cut into ties when the value of the lumber they would make is not more than that of the ties the same stick would produce.

The greatest tie producing section in the United States is that portion of the country extending from Virginia to Missouri and Arkansas, south from the Ohio river to the Gulf of Mexico. In this territory the oak family predominates in the north and the pine family in the south. In addition to saw mill logging and tie operation in this section, there are thousands of farmers producing millions of cross-ties annually.

From the point of making in the woods the ties are hauled by wagon to rail or water transportation; thus the tie producing territory is limited to strips of land lying on either side of railroads or rivers, varying in width according to the condition of the wagon roads and the value of the tie at the point of sale. Ties are seldom hauled by wagon more than twenty-five miles, and this distance could be made only on good roads. The railways traversing timber lands buy ties for their own use along their right of way. Ties are piled a certain distance from the track convenient for loading in ranks or cribs and are inspected and branded by the railroad tie inspector and spotted with paint before being loaded.

Another method of handling ties is where the railroad crosses or touches a river or stream. Ties are bought along the banks of rivers or streams at landings, the same as along railroads at stations or sidings. On navigable rivers the tie company contracts with a tow boat company to barge the ties to the point of shipment by rail, where an incline track is laid into the water. The tow boats take from three to six empty barges up stream and work down, rigging up chutes to the ties on the bank and loading the barges down as far as possible. The barges are delivered at the loading point to a harbor boat, which spots them at the incline and does the work corresponding to that of a switch engine in a freight yard.

On streams that are not navigable ties are bought on the bank the same as on navigable water, but are held until conditions are favorable for rafting. They are then put into the water and made into rafts and floated down stream to a loading point.

The usual method of loading from a raft to cars is by a tie hoist, which consists of a cradle lowered and raised on an incline track from the water to a loading platform. This kind of a tie hoist, operated by a gasoline engine, is efficient and can be installed at a reasonable cost. Where the bank of the stream is low the rafts are sometimes broken up and hauled out by horses, then loaded into cars by piece work or banked to be loaded into barges later.

In railroad territory, ties may be moved at any time of the year, the only hindrance being car shortages or strikes. But in river territory many landings are accessible for only one or two months in the year, so that in buying a large stock of ties under such conditions great care should be used in cleaning up such landings when conditions are favorable.

Country merchants buy ties, paying cash or giving merchandise credit in exchange. The permanently located mer-

F. J. ANGIER,
Supt. Timb. Pres., B. & O. R. R.
Secretary-Treasurer.

chant has an advantage over a tie buyer who is making the same point only once or twice a month. This has led to the establishment of local yard men, paid either on a salary or commission basis. These men buy ties on the ground as they come off the wagons, inspect and pay cash for same. They in turn are checked up by the tie buyers. In many cases a local merchant acts as the company agent, and the tie company takes the inspection of the merchant, verifying his count and spotting the ties.

Ties are very seldom sold to a railroad and shipped to same subject to inspection. The rule is for the railroad company inspector to inspect all ties as they are loaded into cars from the ground. There are two exceptions to this, namely, when the ties are shipped into a concentrating point for transfer either by rail or water. If the ties are to be transferred to another car and shipped by rail, the railroad company for whom the ties are destined, inspects at the point of transfer. If by boat on cargo shipments, this is also the case, but on river shipments by barge the ties are not inspected by the railroad tie inspector until they reach their final loading point to be shipped by rail.

One railroad company which is getting out specifications for treatment ties this year, has limited its ties to the red oak family exclusively because last year some 90,000 ties were split into fuel wood at the treating plant on account of rot.

Discussion.

W. F. Goltra.—Many ties rot while seasoning in air, due to fermentation of sap during the excessive time necessary for air seasoning. Ties should be steamed when received at plant, killing fungi, dissolving sap, causing ties to air season in much shorter time.

E. A. Sterling.—Most of our ties at the present time are hewed ties, but the use of sawed ties is bound to increase. When sawed ties become more common, ties will probably be sold on a board foot basis which will materially increase the cost. With respect to ties rotting before treating, no trouble is experienced with the northern birch and gum can easily be seasoned from 8 to 12 months if received in good condition. It is practically impossible to steam ties immediately after being cut, as it is impractical to locate steaming plants in the woods. Decay is not produced by fermentation of the sap, but by fungus.

D. Burkhalter.—Beech and oak will season for a long time in air without rotting, if received in prime condition and piled correctly.

J. B. Card.—If piled correctly there is very little decay of ties air seasoning for two years.

T. R. Joyce.—I will state that the 90,000 ties which rotted, were piled in solid stacks along the right of way, with no provision for circulation of air through the piles.

J. H. Waterman.—Mr. Joyce's paper is very commendable. I personally advocate that all tie wood should be cut in the winter months when the sap is down in the tree. Timber cut from April to August and left laying on the ground will be worthless, from a treating standpoint, in six weeks.

W. F. Goltra.—Dry rot is caused by sap fermentation. Decay starts very soon after cutting.

Howard Weiss.—Just what rot is has not yet been definitely settled. Decay does in many cases work from the inside toward the outside. This is because the exterior is case hardened and there is no moisture to support fungus growth. Rot is, however, caused primarily by an exterior attack. There are organisms which attack wood from the inside, but there is little proof that these organisms cause any deterioration affecting the quality of the wood for commercial uses. Sap coloring fungi do not depreciate or cause deterioration of the wood tissues. There is no such thing as dry rot. The house fungus, however, exists on very little water.

Walter Buehler.—We have always found that if timber is cut when the sap is down, and then properly stacked, that it will season properly.

Economic Materials for Boat and Barge Construction.

By A. E. Hageboeck.

White oak has been used almost exclusively in the past for the construction of model-shape steamboat hulls. The present tendency is to use steel, and for this purpose we believe that steel is the more economical. There is much data to prove the economy of treated timber barges, however.

Pressure-treated yellow pine barges have been used on the lower Mississippi for twelve years. These barges are today in a perfect state of preservation, and without doubt are good for an additional life of ten years.

It seems safe to estimate the life of creosoted fir barges at 20 years, since untreated barges have given an average life of 15 years. The major portion of the repairs on an untreated barge are for calking and repairs to deck, rake and gunwhale joints, on account of decay. As the present tendency is to air season the fir before treatment, it seems natural to believe that the barges will give a long service without re-calking. As an additional precaution it is thought advisable to protect the creosoted deck with a one-inch wearing surface of untreated material. The repairs to the deck are, therefore, confined to the occasional relaying of this protection.

The yearly costs show the following relative order for economical barge construction: Creosoted fir, creosoted yellow pine, untreated fir, untreated yellow pine and steel. These yearly costs also show that the annual cost of a steel barge is twice that of either a fir or pine creosoted barge.

Cutting and Seasoning Timber.

By August Meyer.

As the scarcity of timber for railway ties becomes more and more known to manufacturers and railroads of this country it has been found necessary, in order to comply with the increasing demand, to use a larger percentage of inferior species of wood which heretofore has been considered as of little or no value for railway ties.

Among those woods which have been brought into use are the hard and soft maples, gum, sycamore, birch and beech. However, none of the above have, up to the present date, given very satisfactory results on account of their tendency to a rapid decaying during the seasoning period, and only when a successful seasoning has been obtained are any of the above kinds of wood worth treating. However, there is no doubt that hard maple, and more especially the beech, which possesses a great spike-holding power, will make a very good tie when thoroughly seasoned and treated.

When beech ties are cut in the winter, properly taken care of, and seasoned at least from six months to one year, a very good treatment can be obtained in the heart and sapwood both, more especially when a zinc chloride solution is used either alone or mixed with creosote. Whereas if the beech ties are made from timber cut in the spring or summer and piled up to season it is nearly impossible to keep the wood from decaying and splitting. The writer has seen beech ties which, when received at the treating plant, have been covered with fungi, and therefore absolutely worthless for treatment, although it was claimed by the shippers that these ties were cut during the months of February and March, or during the time when no sap was expected to be in the wood at all. An examination of some of these ties showed that the wood contained a considerable amount of sap. For instance, where pieces of bark had not been removed, under this bark the wood was absolutely green and full of sap, which indicates that the sap starts up in the trees as early as February, and that the timber ought to have been cut before this time.

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Genl. Supt., Ayer & Lord Tie Co.,
First Vice-President.

The splitting and checking of the above named woods might also be due to a larger extent to cutting the timber in the wrong season. We all know that beech is a very close grained wood, more especially the heart, which seasons very slowly and when the less dense wet sap wood dries out and contracts more in proportion than the partly dry heart wood, it is bound to split more than if the entire piece contained nearly the same amount of moisture.

In regard to the physical strength of wood cut in the different months, very interesting tests were made by the Economical Society, Westfalen, Germany, giving the following results:

Beech timber cut in December and January gave an average mechanical life of six years, whereas the same kind of timber cut in the same location in February and March gave only a service of two years. Similar results were shown for spruce wood.

Of four spruce trees, which were growing very close together in the same kind of soil, of the same age, and apparently alike, one was cut in December, one in January, one in February and one in March.

It was found by test that the wood in the tree cut in January possessed only 88 per cent, the wood of the tree cut in February possessed only 80 per cent and the wood of the tree cut in March possessed only 62 per cent of the strength of the wood cut in December.

In cases where the treatment fails to preserve the wood for the required length of time, or in cases where the strength of the wood is greatly weakened, a thorough investigation will in most cases prove that such material had already lost a good deal of its strength before treating, either by decay or by having been cut in the wrong season.

It is of no use for the consumer to buy lumber, ties, etc., and burden this material with an extra expense, unless it is absolutely known that the material is worth this expense, and every precaution ought to be taken to have the timber cut in the proper season and properly taken care of, because it is impossible by any process to obtain full value of material which had been more or less ruined before subjected to treatment.

Discussion.

W. F. Goltra.—It is useless to specify in what months timber shall be cut, as the purchaser is not able to tell by inspection in what months the timber was cut.

J. H. Waterman.—Several railways can and do specify that ties shall not be accepted unless cut in certain months.

F. S. Pooler.—I find that it is almost impossible to control the companies which furnish ties.

J. T. Logan.—Labor conditions have made it impossible to get ties cut only in specified months.

G. W. Signor.—The organization of a timber cutting company cannot be broken up during the summer months, so it is necessary to cut timber the year round.

The Scientific Management of Timber Preserving Plants.

By D. Burkhalter.

Webster's definition of "manage" is "to direct, to control, to cope with, to wield with address."

The treating plant operator should "direct" the placing of certain material in the retort, "control" the amount of preservative pumped into the retort, "cope with" the labor and car supply necessary to put the finished material on cars for delivery, and "wield with address" from there on.

It can hardly be doubted that the largest profits in the business of timber preservation at the present time arise from the unearned income coming from the rise in the market value of the timber during its period of service after preservation.

In the last decade this rise has been large and practically continuous. And the fact that it is expected to continue, accounts for the rapid increase in the number and capacity of timber preserving plants. In order to derive the largest

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possible profit from this source, the manager would "select from among existing methods" the one which afforded the greatest longevity of product.

Applying this principle to railway cross ties, the question of screw spikes and tie-plates is considered still open by the engineering profession, but to a timber treating man it is plain that their use is advantageous.

The lowering of labor efficiency among the Latin races through too frequent holidays is well known. Such a difficulty seriously affects the operating organization. The carrying of an increased force at slightly higher rates is the usual result, the tendency to aggravation of the disorder by larger earnings in a day being counteracted by the lesser amount of work supplied each man on a piece-work basis.

It may happen that "over-head charges, and depreciation, etc.," are high enough to point towards a reduction in net cost per tie through the payment of wages high enough to ensure maximum output. The opposite effect is observed when the scheme of treatment provides that the ties always wait for the slowest among them to absorb the preservative.

When more than one man is required to handle each piece.

assuming it to be a tie both for general application and convenience, complications not heretofore mentioned become prominent.

A two-man crew will handlie ties weighing 170 pounds, and a three-man crew 270 pounds. In putting ties on trams direct from road-cars, the distance from tram-track to road-car is to be considered, and also the design of tram-car arm. In a two-man crew, with one man inside the car and the other out, with ties weighing 175 pounds, there is the least waste of time or effort if the ties be shoved or hauled, with some support in the doorway or on side of car. This assumption that these conditions call for a two-man, instead of a three-man crew, is borne out by the earnings per man being greater in the first case than in the second.

The loading of treated ties into open cars homeward bound is usually accomplished with a derrick, a tram-load at a time.

The output per unit of space on the loading platform is increased with every increase in the size of the crew. This reduces the time of making up trains, and affects favorably both switching movements and the supply of trams.

A three-man crew works advantageously in unloading box-cars into storage. In practice one man can throw out a tie which it takes two to carry away. And where piles are three tiers deep, i. e., track centers 72 ft. for an 8-ft. tie, ties may be so heavy or piles so high as to require all three men in carrying. With the usual remote location of tie-plant real estate, and heavy ties, the extra effort required to maintain the third tier will capitalize in terms of considerable trackage.

There are two more questions of yard layout that vitally affect any scheme of operation. One is an arrangement that will supply empty trams for reloading as fast as they are released, 1, whenever the number of trams is limited; or 2, the speed of working the crew is low; or 3, the area to be worked is limited; or 4, the approach of darkness is imminent.

The other point is the use of a parallel track instead of a third rail in lumber yards where cars may be expected to come in with forty sizes of lumber on each load to distribute along a thousand-foot frontage of different dimensions. Really busy tracks of that character would require a narrow gauge on each side.

Efficiency is increased by any betterment in the grade of labor. For instance with ties weighing 150 pounds and with a two-man crew, pay $2.10 for the first 300 ties; 40c. for the next 50; 45c. for the next fifty, and a cent a tie thereafter. This method culls out the low class of labor. The gradual accumulation of skilled workers brings flexibility of operation. Such a grade of men is likely to be more contented also. They will work at top speed for about seven hours only.

GRANT B. SHIPLEY,
President, Pittsburgh Wood Preserving Co.,
Third Vice-President.

Too often a legacy of chaos is bestowed on the newly arrived operator. The timber may have been arriving for some time, in spite of the fact that improper location in the yard is pretty certain to result in constitutional weakness in operating efficiency that it may take years to eradicate.

The quicker things get going the sooner dividends arrive. If, in the mean time, a clerk has learned the names of employees, and the stationery for a loose-leaf accounting system is on the shelves, ontrol will come the sooner. Personality is a most effective factor. A smiling demeanor, an unruffled front, a strict adherence to the letter of any promise made, and an accurate recollection of the details of any conversation conveying orders is quite essential.

The small plant is like the country store. There is little likelihood of ineffectiveness, unless the boss himself is ineffective. The treatment of timber is more uniform in a retort holding only one carload than in a retort of twice the size. A foreman, a checker, a locomotive engineer, a clerk, two pairs of enginemen and firemen fill the bill for salaried men; and the superintendent directs the treatment of every run, the handling of the ties, the switching of the cars, the inspection of the material and creosote, the repairs to machinery and the compilation of reports. However, the opportunity for closer control of treatment is an offset to high "overhead charges."

In a large plant, we find everything subdivided. The office is in charge of a head accountant or cashier; the engine-room has a chief who is responsible for maintenance, and has a shop with machinist and blacksmith; treatment is supervised by a chemist in a laboratory equipped to detect adulteration in creosote; the general foreman outside has an assistant, a chief inspector, timekeepers and checkers, with sub-foreman in charge of receipts and shipments of materials of many kinds, with straw bosses for each crew, and a number of other persons in charge of details.

For effective control, nothing is better than a schedule to cover the next 48 hours, put out every day at about the same hour. Dictate to a stenographer the program of the runs to be made, showing the serial numbers for 48 hours, with the hour and minute due in and out of the retorts, the contents of each retort, and length of train, and furnish copies to all concerned.

The interchange of notes is promoted by the use of compartment boxes in the office and the requirement that periodical visitations be made to it, and that suggestions for betterment be left in it.

When the time of treatment varies from three to thirty hours, there is room for much planning. The long pull should arrive at night, and the briefest events take place in the daytime, at the most favorable hour, and nearest the retorts. It is possible to make five trips in 24 hours with three sets of tram cars, and carry the load on a tie organization fairly steady.

If it be admitted that the greatest irregularity in time of treatment indicates the greatest success in classifying material for treatment, conversely, by assuming that uniformity in time is a marked aid in all directions to ease of operation, there should be great room for the exercise of skill in putting together trains of refractory and easy stuff in a way to accomplish the purpose.

Enthusiasm is a cash asset and worth spending money to get. Everybody around the plant should be interested to hear how the last run fared, and what conditions surround the next one. Weighing and cutting ties is the ordinary method of determining results. The experimental cylinder is highly valuable—the microscope most likely to furnish the latest news.

Efficiency in Plant Operation.

By E. A. Sterling.

Modern business management demands a reduction in operating expenses in order to keep net profits from falling off on account of keener competition and the higher cost of labor and material. To meet this need, a comparatively new business system, known as scientific management, is being evolved and put into practice in many industries. Its end and aim are greater efficiency, and in its development one of the surprising features brought out is the woeful lack of efficiency in many commercial enterprises, both prosperous and otherwise.

Greater efficiency in plant operation is brought about by a refinement of details and by the application of a definite system to every step in the business. Not only is every operation systematized, but every individual is taught to follow definite instructions for each day's work, and his efforts are so directed that he is able to accomplish more with the same expenditure of energy.

As to how far the principle of scientific management can be applied to wood-preserving plants, further developments alone will disclose. It is certain that there are ample opportunities for increased efficiency at many plants. On the other hand, there is less opportunity to decrease operating costs than in manufacturing plants, where labor constitutes a larger percentage of the cost of the product. At a creosoting plant which treats ties with, say 10 pounds of oil per cubic ft., at a cost of 35 cents, approximately 80 per cent of the cost will be represented by the creosote, 5 per cent by overhead charges and 15 per cent by labor; while in many purely manufacturing establishments labor may constitute more than 50 per cent of the total cost. Assuming that labor charges are practically the same, regardless of the process, it follows that the percentage value of the preservative used is less with the cheaper treatments and the possible saving by increased efficiency becomes a higher percentage.

In the application of a system which will insure greater efficiency in operation, the local conditions at each individual plant play a large part, and the man in charge must work out most of the problems for himself. There are, however, several fundamental conditions common to all plants which may form the basis for cost reduction all along the line.

In the yard there is the question of general management as related to economic unloading and proper seasoning. The piling system should give maximum rapidity of seasoning, and the arrangement should be such that the unloading can be done without carrying the ties too far or too high. Efficiency engineers assert that each man should be carefully instructed by a superior in intellect as well as rank as to just what moves to make, how to make them, when to rest, etc. In some cases carefully thought out mechanical devices may be the means of reducing costs in tie handling.

In changing charges and in the mechanical operations during treatment, little manual labor is involved, and efficiency becomes a matter of saving time, fuel and preservatives. In the one operation of opening and closing the cylinder door, much time can be saved, and men properly directed will do the work much quicker and easier than by their own method. In the engine house speed of the pumps is an important factor, and their proper regulation will have a marked influence on steam consumption, time and character of treatment, and cost of maintenance. The firing of the boilers, the operation of the valves, and the many other every-day operations will bear close study with the view of steam economy, better penetration and saving of time.

Proper plant equipment is essential to efficient operation; while facilities for prompt and careful repairs of tools and machinery will reduce maintenance charges. Large pipes for filling and emptying the cylinder, ample steam capacity of the boilers, and oversized rather than small pumps will increase the output and reduce costs. Cylinder cars are an important part of the equipment, yet, at many plants, small, hard-running cars without coupling attachments are still used. It is economy to scrap worn-out or antiquated equipment and replace it with new.

Men in charge of plants sometimes oppose efficiency methods since an assumption that increased efficiency is possible may be interpreted as a reflection on the ability of the man who has given his time and best thought to his plant for years. This very fact, however, may be the strongest reason why a new viewpoint is desirable, since it is very easy to get into a rut and become so intimate with the daily routine that possibilities for improvement are overlooked or not believed possible.

Discussion.

Andrew Gibson.—Plants treating uniformly the same kinds of preservative, can reduce their operation to a scientifically efficient basis, but each different class of wood requires a different method of handling. When employes give good service, efficiency will be attained, but each employe must work for the best interest of the whole plant and not at the expense of another department. Piece work is much preferable to day wages in attaining efficiency of plant operation.

J. H. Waterman.—The plant efficiency depends on the percentage of time the retorts are kept busy, it being conceded that the treatment given is thorough. Piece work gives the greatest efficiency. An interest in laborers and care of them tends toward higher co-operation, and hence efficiency. The efficiency of the Galesburg plant has been greatly increased by a system of delay-reports devised by F. J. Angier.

F. J. Angier.—These reports show retort number, date, length and cause of delay. At the end of the month totals are made and tabulated, and remedies are applied if possible. Twenty minutes is allowed for changing a cylinder charge, and all above that is tabulated as delay.

A. E. Sterling.—I think that a schedule should be made out and adhered to as closely as possible, although there are many difficulties. Instruction cards should then be issued to the employes outlining the schedule and methods.

Creosote Oil—Specifications and Methods of Analysis.

By S. R. Church.

Creosote oil is a by-product of a by-product.

This is an age of specifications, and no manufacturer can expect to sell his products except on specifications, even if he is marketing a by-product. The tar distiller, however, faces a somewhat difficult situation. On the one hand, his raw material, coal tar, is what it is. So far, no one has ever succeeded in buying coal tar on specifications from a gas works or by-product coke oven plant, except that excess of water can be deducted from the bill. It is a hard matter sometimes even to make the gas companies believe that their tar does contain water. On the other hand, the distiller must take this tar and produce from it pitch of various grades to meet the requirements of the roofing trade, paving trade, briquetting industry, and all the other purposes for which pitch is used. One of the problems of the tar distiller is to so combine tars of varying characteristics as to produce refined tars and pitches of uniform quality. The large distiller, by reason of having facilities for storing tar in great quantities, and for keeping different grades of tar separated in storage, can accomplish this, although it involves long hauls of raw material. In distilling these tars to pitch, creosote oil is obtained, and, just as the pitch has to meet certain tests, so the oil must, as before stated, comply with certain specifications. Of course, the character of the oil—that is, its specific gravity and boiling point—depends more than anything else upon the grade of pitch that is being made; for instance, if you make very hard pitch, and take off more oil to do so, then the oil as a whole will have higher boiling points.

In the beginning of the tar industry in the United States, the mainstay, and still the most important part of the busi-

ness, was the production of roofing materials, and this is still the largest single department of the industry. In the manufacture of tar roofing materials we are as far ahead of Germany today as Germany is ahead of us in the manufacture of the coal tar colors. Therefore, the first thing that the American tar distillers tried to do was to produce the best possible grade of pitch for the roofers. Not much was heard then about specifications for creosote oil, although the creosote oil was all sold to railroads and to large commercial creosoting concerns, whose business dates back to about the same period, and presumably it was good oil, for the use of it enabled these concerns to build up a very extensive and lasting business.

For some years the tar distillers in the United States have realized that conditions are changing. The roofing business, though still of tremendous proportions, no longer represents the only large outlet for pitch. Coal briquetting with pitch binder is already an industry of no mean proportions. In an endeavor to obtain as much creosote oil and as high boiling oils as possible, the use of hard pitch for various purposes is being actively promoted, and chemists are continually carrying on investigations looking toward new uses for coal tar pitch.

The by-product coke oven is already a more important factor in the production of coal tar than the gas works. It looks as if the prejudice against the use of by-product coke in the steel industry is being rapidly overcome, and that there will be a very largely increased production of coal tar in this country. Doubtless the amount of creosote oil that can be imported from Europe will decrease.

It is my purpose in this paper, without going very far into the merits of different grades of oil from a scientific standpoint, to briefly state and answer a few questions, in the hope that their consideration may be mutually helpful.

Without question the creosote oil specifications of the American Railway Engineering and Maintenance of Way Association (as published in Bulletin 107, January, 1909, in the report of the Committee on Wood Preservation), is the most widely known and probably the most widely used of any. The railroads consider this a standard for oil for tie treatment, to which they would like to adhere as closely as possible.

Poles and cross-arms do not, as yet, constitute a very large class of treated timbers, one, however, that will no doubt become of much greater proportionate size. The National Electric Light Association, representing ninety per cent of the light and power companies of the United States, having adopted a specification for oil, it is interesting to compare same with that of the American Railway Engineering Association.

From a comparison of European specifications I think it can be safely said that the European specifications are largely the result of the following condition: one railroad, or government office, after years of experience with oil from some particular tar refinery, believing the results good, would draw a specification to cover (not too closely) oil of that character. No such widely adopted standard as the American Railway Engineering Association specifications exists today in any European country. So far as I have been able to learn, they are not very particular as to exact compliance with the requirements of the specification, as long as they are satisfied as to the origin of the oil.

In regard to the origin of our "standard" specification, it is unnecessary for me to trace its history, which is familiar to those who are interested in this matter of specifications. Suffice it to say that the specification represents a general tendency in favor of what is known as "high boiling" oils—that is, oils containing as little as possible distilling below 235 degrees centigrade. I think I can say, without fear of contradiction, that the sentiment in favor of this high distilling oil is not due to failures of timber preserved with oils of lower range. The new specification is rather a result of certain tests that have tended to show the volatility of the low distilling portions of the oil.

In other words, this specification and other specifications like it, calling for oils of high distillation range, were not drawn, like the European specifications, to describe oils already in use, nor were they drawn on account of failures of oil used in the past, but they largely represent theories of what might happen as indicated by these evaporation tests, etc.

Would any modification of the specifications be desirable? The justification for this paper, if any can be afforded, lies in the answer to this question. It must be answered from two standpoints:

(a) Are the consumers of oil justified from a theoretical standpoint in demanding as "high boiling" an oil as required by the American Railway Engineering Association specification?

(b) Would a modified specification be desirable from a commercial standpoint?

In the first place the American Railway Engineering Association specification is more rigid than the specifications governing oil used by the European countries in general, and by the railroads of Great Britain particularly. It demands oil of higher boiling character than is used by the oldest commercial creosoting concerns in the country for general timber treatment, and higher than the National Electric Light Association's recently drawn specifications for oil for poles and cross-arms.

(a) It seems perfectly rational to believe that, other things being equal, a high distilling oil is desirable from the standpoint of permanency. We should not, however, lose sight of the following points:

First. From the standpoint of antiseptic efficiency the highest boiling portions of the coal tar creosote are not as effective as the middle portions of the oil.

It is unquestionably good practice to limit the percentage of oil distilling below 205 degrees or 210 degrees centigrade to a minimum, as the light oil, which distils below that temperature, has no place in creosote, and hastens the evaporation of higher fractions.

(b) From a commercial standpoint, it is easy to show that the American Railway Engineering Association standard is unreasonably high. The only commercial creosote oil produced in large quantities that will meet these requirements is the German oil. An exhaustive series of tests was made in our laboratories recently, in which twenty-six different tars produced in the United States were distilled separately to hard pitch. The oils obtained from these distillations averaged as follows:

Below 210 degrees centigrade, 11 per cent.
Below 235 degrees centigrade, 43 per cent.

Of these twenty-six oils only three could meet the American Railway Engineering Association specification. In order to make them meet this specification it would be necessary to reject, by fractionation, at least one-third of the oil. I have said before that it is desirable to eliminate the true low boiling oils or those distilling under 210 degrees, and that can and should be taken care of by the tar distiller in fractioning. But the limitation of the 235 degree fraction to 25 per cent would, if rigidly enforced, eliminate over one-third of the English and American oil.

Considerable discussion has been taking place in the last six or seven years about the method of making the distillation test, and yet very little has been added to Von Schrenk, Fulks and Kammerer's summing up of the discussion before the American Railway Engineering Association, as published in Bulletin 72.

The position of the thermometer makes a tremendous difference in tests and right here is a point worth noting. The distillation test, as practiced in Great Britain is similar to our own standard method, with the exception that the ther-

mometer is placed in the liquid. On a given oil, the difference in the percentage distilling below 235 degrees, having the thermometer in one case placed in the liquid, and in the other case placed one-half in. above the surface of the liquid, will be over 10 per cent of the total oil, and in some cases as much as 15 per cent. There are a great many cases where large cargoes of English oil, tested by Mr. Nicholls, a recognized English authority on creosote, would, according to Mr. Nicholl's reports, comply with our Railway Engineering Assn. specification, but when tested by the American method would not meet that same specification. There is no question but that the American method of distillation, with the thermometer above the surface of the oil, is far more rational than the English, but the British manufacturers have been able so far to prevent any change in the method.

It may be well to call attention to the fact that if the distillation of creosote oil were to be put on a strictly scientific basis, it would be necessary, in addition to using a scientific form of distilling apparatus, to pay a great deal more attention to the question of thermometers. This particular problem appears to have been overlooked. It is probably true that the proper correction for the emergent stem would result in greater differences in the results of the analysis than any modification or change in the type of distilling vessel.

Discussion.

C. M. Taylor.—The present method of testing creosote is really a fractionation and not an analysis or distillation. However, the oil accepted under standard specification is O. K. in 99 out of 100 cases, if supplementary tests are used which are seen to be necessary in special cases.

S. R. Church, in answer to a question stated that the tars tested were representative oils.

Evaporation of Creosote and Crude Oils.

By P. E. Fredendoll.

All oils when exposed to the atmosphere either in timber or in a container of any shape or size are constantly subject to a loss by evaporation, which varies according to several conditions. It is the endeavor of the writer to point out that this evaporation from treated wood is greater than generally conceded.

A large number of ties were treated at Somerville in December, 1904, and were placed in the track at various places on the A., T. & S. F. Ry. in the early part of 1905. Unfortunately we have no record of individual weights before and after treatment by which we can determine the actual absorption of certain ties during treatment, but the average absorption was about 4.37 lbs. per cubic ft. During the summer of 1911 three of these tires were removed from the track —one from Garnett, Kans.; one from Dodge City, Kans., and one from Chillicothe, Ill.

In taking these ties from the track care was used to pick average ties. These were sent to the laboratory and extractions made on each with the following results:

Locations	Cu. ft. in tie	Lbs. of oil in tie	Lbs. per cu. ft.	Per cent remaining assuming 4.37 original amount
Garnett, Kans	2.95	3.96	1.34	30.66 per cent
Dodge City, Kans	3.40	5.47	1.60	36.59 per cent
Chillicothe, Ill.	2.83	8.22	2.90	66.36 per cent

We cannot determine the loss due to the nature of the oil because we have no analysis covering the original oil used.

In 1898 some piling was treated for a bridge at Dean Lake, Mo. This piling was short leaf pine and was steamed before being submitted to oil pressure, and the records show an absorption of 29 lbs. per cubic foot.

In June, 1911, a sample of one of these piles was sent to the laboratory and on extraction showed 7.82 lbs. per cubic foot, or 20.07 per cent or the amount originally injected into the timber.

In July, 1908, we treated about 200 hewn pine ties at Somerville for experimental purposes. They were weighed individually before and after treatment and were left at Somerville piled in 7x2 piles and weighed at various times for three years, and are still on hand. They were taken from one of the piles on a track that we were treating from at that time and were treated with a regular run in one of the large cylinders, so that they were subject to the same conditions as our regular run of ties.

In July, 1911, one of these ties which took about an average amount of oil was cut up and samples from it were extracted in the laboratory.

In the treatment the tie absorbed 18 lbs. of creosote by actual weight, and extraction showed only 8.21 lbs. remaining in the tie, an amount equal to 44.38 per cent of the original absorption. Below are given analysis of creosote at time of treatment and of sample extracted from tie:

	Original Oil.	Extracted Oil
Specific Gravity @ 15 C	1.0422	1.0688
Distillation—		
Up to 200 C	1.8	none
200 to 210	1.2	none
210 to 235	16.7	10.4
235 to 315	61.0	24.9
Residue above 315	19.3	64.7

In November, 1908, we treated 40 hewn pine ties, and these have been kept as the above. In August, 1911, one of these ties was sawed and an extraction made. Weight before and after treatment showed the absorption of this tie as 49.5 lbs. On extraction in the laboratory it shows 31.8 lbs. still in the tie, or an amount equal to 64.24 per cent of the amount originally injected into the tie. The ties have not been in track service but in open piles, which allow the air to circulate freely about them. The effects of different kinds of ballast on the exaporation is a question that cannot be taken up in this paper on account of lack of information along this line. A close investigation of this question might give us some valuable information.

It might be well to call attention here that although pan evaporation tests show an alarming amount of the lighter fractions of the creosote lost during test, this is not noticed to nearly so great an extent from the timber itself, because that portion of the oil which is in the interior of the wood is protected from the atmosphere. But the pan tests are of value for comparison of various oils and shows the tendency of the lighter fractions.

The effect of different amounts of preservative on the evaporation is illustrated by the two ties treated at Somerville in July and November, 1908. The first tie lost 9.19 lbs. of oil, which was equal to 55.62 per cent of the amount originally left in the tie, while the second tie lost 17.70 per cent lbs., or 35.76 per cent of the amount originally left in the tie by the treatment. This shows that while the percentage of evaporation from the first is greater than from the second, the actual loss in oil is greater from the latter.

All analyses given in this paper were made by the Maintenance of Way method except the one from the Forest Service circular 112.

In conclusion, I will say that I think there is need of a good deal more work along this line with a view toward finding some oil or tar that, when mixed with creosote, will lessen the rate of evaporation of the creosote from the mixture. Just what effect the addition of a high boiling crude oil has on the evaporation of the creosote from treated timber had not been determined, as our tests have not been running long enough.

Discussion.

S. R. Church.—We are carrying on tests on evaporation, and these seem to show that if all oils are excluded that boil below 210 degrees, that boiling below 235 degrees does not matter much.

H. M. Newton.—Analysis of creosote oil extracted from timbers shows little of low boiling portions, showing these constituents have no place in creosote oil. Analysis of tests in this paper show an increase in the amount of high boiling oils in extracted oils, above the original. Similar results are shown from pan tests. Crude oil acts in the same manner.

W. F. Goltra.—I believe all oils boiling above 210 degrees are efficient as preserving agents.

H. M. Rollins.—We know of treated piles which have lasted for 35 years, although the percentage of light oils was undoubtedly high.

Howard Weiss.—We have made some experiments with short leaf pine piles from Louisiana of uniform size and seasoning. Creosote oils with boiling points as follows were used: (1) 0 degree to 205 degrees C; (2) 205 degrees to 250 degrees C; (3) 250 degrees to 295 degrees C; (4) 295 degrees to 320 degrees C; (5) above 320 degrees C. Each pole was given a full cell treatment with 18 lbs. to the cubic ft. After two months' seasoning we deduced the following results: (1) lost 34.7 per cent of creosote; (2) lost 21.0 per cent; (3) lost 16.0 per cent; (4) lost 6.2 per cent; (5) lost 4.0 per cent. One treated with the original oil lost 5 per cent. Heavier grades exert a marked influence, retarding evaporation of lighter oils. However, the lighter oils are made more antiseptic as shown by these facts: 0.2 per cent of (1) prevented fungus growth; 1.25 per cent of (5) did not prevent fungus growth. Evaporation differs in different species of woods. Decay in treated timber is due to antiseptics not reaching every part of the stick. Specifications should not be drawn to suit every case, but in grades.

E. A. Sterling.—Creosote being a by-product, we cannot tie it down too close with specifications.

Wood Paving Blocks.

A paper on Creosoted Wood Paving Blocks was read by A. E. Larkin, general superintendent Republic Creosoting Co., in which the following points in connection with the production of wood block pavements were brought out. The wide variation in the qualities of different species of wood have made it necessary to limit very closely the rules under which paving blocks can be successfully produced. This production involves the cutting of the timber, storing, seasoning, shipping, sawing of the planks, treatment, etc., in each of which there is opportunity for faulty methods to injure the value of the final product. The problem of securing efficient and equitable inspection of blocks is a matter that it is difficult to agree upon between producers and purchasers. A final inspection before laying in the street is recommended as sufficient. The use of original specifications rather than standard specifications is not considered advisable.

A paper on Wood Block Pavement from a Construction Standpoint was read by Day I. Okes, of the Kettle River Co. The most essential factor in the life of creosoted block pavements is the foundation. This foundation should have a smooth surface and should be covered by a cushion never exceeding one inch in thickness and used only to obtain a smooth wearing surface for the blocks. Sand is usually specified for this cushion, although in cases where the pavement is subject to vibration a mortar cushion is preferable. It is usually conceded that block pavement wears best when the blocks are placed at an angle of 45 to 67½ degrees with the curb.

Creosotes and Creosoting Oils.

By David Allerton.

Creosote seems to have been originally adopted in England as the synonym for dead oil of coal tar, and the product was first called dead oil because its specific gravity was greater than water. When first used for preserving wood it was simply creosote, and when it was found necessary to define it by a certain specification, a specified amount of constituents was required as well as a specific gravity greater than water. Afterwards, as more chemical work was done in coal tar derivities, a process of analysis by fractional distillations was devised, the original object being to determine that the creosote had been obtained from crude bituminous coal tar, also a specific gravity greater than water was required; this fractionation was so graded as to eliminate the very light oils and water. The method of distillation was standardized, and that method still obtains, the oil complying with certain requirements in a general way. There seems to be no doubt that all pure tar creosotes are good wood preservatives. It is evident that the less the viscosity of a liquid the easier it is forced into wood fiber, and that in treating refractory wood it is desirable to have a preservative of a very low viscosity. Of course, experience has long ago taught us that it is impossible to get an exactly even penetration in any charge of timber or ties, and the greater the viscosity the greater the variance.

In quite recent years so-called standard specifications have been adopted by different associations defining the specifications for creosote to be used in the treatment of timber and the specifications define the gravity and distillation points, calling for an addition of coal tar or pitch, but viscosity is lost sight of, although but a limited amount of insoluble matter (otherwise carbon) is permitted, it being assumed that no matter how thick and heavy the liquid is it can be made to penetrate wood if it contains no insoluble matter. This is fallacious.

The cause for the excessive oozing of the oil, commonly called bleeding, from paving blocks can be traced very simply to the use of heavy oils, as when they are treated with creosote this bleeding is very slight and increases with the weight of the oil.

Coal tar is inert matter as regards preservative qualities and is used in creosoting for precisely the same purpose as barytes are used in paints, its objection being its high viscosity.

I propose the dead oil of coal tar be designated as creosote; other creosotes, such as wood creosotes, oil tar creosotes, etc., be so designated, and the mixtures of creosote with coke oven tar, filtered tar, or oil tar, etc., be designated creosoting oils; the specifications for such oils to call for the per cent of creosote contained and the per cent and kind of matter added.

Creosote Specifications and Analysis.

By Hermann von Schrenk.

While the general fact that coal tar creosote is a good preservative seems to be generally accepted, there are still great differences of opinion as to the composition of the best coal tar creosote, and how such composition should be determined. I wish to emphasize that these differences of opinion date back for a great many years, and during that times all kinds of creosote oil have been used, and are still being used.

Creosote should fulfill two (and possibly three) requirements. First, it should be antiseptic, i. e., prevent the growth of wood-destroying organisms; second, it should be of such composition that it will remain in the wood as long as possible, i. e., it must be as stable as possible, or as we frequently express it now-a-days, it must not evaporate. To these a third claim or requirement has recently been added, particularly in connection with the wood-paving industry, that it must act more or less as a water-proofing material.

While creosote, more properly called coal tar creosote, is called a substance or compound, it cannot be considered as a definite compound. It is simply a fraction or distillate obtained from coal tar, composed of a large number of chemical compounds which are more or less loosely united. When speaking of creosote, therefore, one must continually remember that it differs in this respect from zinc chloride, copper sulphate, lime or any of the other substances used in wood preservation.

The first requirement of creosote is that it must be antiseptic. The question early arose as to what parts of creosote were most effective in preventing decay. The discussion involved the tar acids and naphthalene principally, and practically all students of creosote oil agree that both are good antiseptics. The vital point in this discussion concerns itself not so much with the antiseptic value of these compounds as it does with their stability or permanence in the wood. I have no hesitation in saying that probably all parts of creosote oil are sufficiently antiseptic to present decay, i. e., for practical purposes. Pieces of wood treated with naphthalene, low boiling tar acids, high boiling tar acids, coal tar, etc., have been in our rotting pit for years, and where the preservative injected is still present in large quantities, the wood is sound. The minute the preservative disappears, decay sets in. This is particularly instructive in the case of naphthalene. The pieces were injected with all the naphthalene they would hold. For three years they remained solid. Now much of the Naphthalene has disappeared (determined by weight), and the pieces show it. A good many results have also been obtained from pieces of creosoted wood of different ages and exposures. All of these pieces were sound. In the oldest pieces only the highest boiling compounds were present, and these pieces are sound; in others, where much naphthalene was originally used, and where it was prevented from escaping (as in piles under water) the wood is sound.

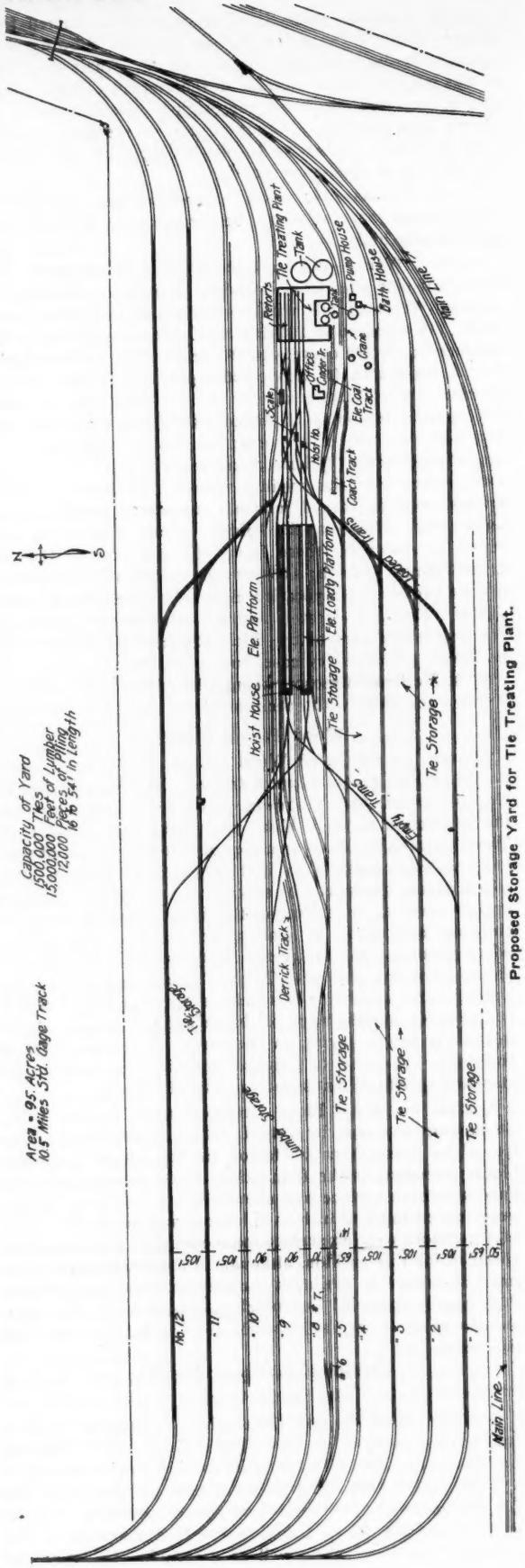
The second requirement of creosote is that it must be more or less permanent. Investigations of the last years have shown that all creosote oils after injection into wood change in composition. These changes are due largely to the fact that some of the compounds evaporate. In a paper published several years ago my associates and myself showed by comparative tests of the same oils exposed in open pans and injected into wood, that the lower boiling fractions of the creosote evaporate with the greatest rapidity, and as the fractions increase in specific gravity (and as their boiling points rise), the rate of evaporation decreases, reaching an approximate permanence in the pitch.

Table Showing Loss by Evaporation of Fractions of an Oil.

		Sp. Gr.	Loss after 14 mos.
210° C.—235° C.	fractions.....	1.008	90.4%
235 —270	.....	1.022	71.9%
270 —315	.....	1.053	26.5%
315 —355	.....	1.059	4.0%
Residue	.....	1.206	0.0%

Reverting to the statement that all parts of coal tar are antiseptic, and therefore acceptable, it appears, when their stability is considered, that many of them should be ruled out. In view of the different composition of creosote oils obtained from different coals and countries, and in view of the general value of all compounds from an antiseptic standpoint, furthermore in view of the rapid disappearance of the low boiling fractions (meaning thereby those distilling below 235 degrees C.), what more can be said for a good creosote oil than that it must be a coal tar product and have as small a percentage of low boiling compounds as possible?

This brings us to the question of a specification. I have frequently, in later years, warned against too great refinements in a specification. There are many kinds of creosote oil whose actual composition is beyond control, because that depends on the coal. If the distiller has a pure coal tar product with a small part of same consisting of low boiling compounds, he makes a good creosote oil. That is the view of the Europeans, and their specifications are extraordinarily simple. I was told by railway officers in several European countries this winter that the American Railway Engineering Association specification met their ideas more completely than any of their own. It calls for a high grade oil, such as will fulfill the requirements, indicated by past experience. My claim is that the heavier the oil the more certainty there will be that long life will be obtained, just as it has long been



known, and is becoming increasingly evident, that the larger the quantity of oil injected the more certain will be the results in the long run.

Reference has been made to a third requirement of creosote oil, namely, water-proofing qualities. This has arisen recently in connection with American paving block treatment. Specifications were written calling for very heavy "creosote oil;" in many instances the specific gravity called for was 1.10 or more. Any one familiar with coal tar creosote realizes that such a requirement is impossible, because there is no coal tar creosote (at least none in quantity), having such a high gravity. The heaviest oils known rarely exceed 1.082. Creosote will water-proof wood to a certain extent; the extent will be largely determined by the quantity injected. A good heavy creosote will answer every purpose, as has long been demonstrated abroad and in many places in this country. Where an engineer believes that his local requirements require an oil having a specific gravity of 1.10 or more, he can, of course, use same, providing that he realizes that such an oil can be obtained only by putting tar or pitch into his oil.

There remains a brief mention as to methods of analysis. A creosote analysis consists essentially of two parts; a chemical determination for the purpose of detecting adulterants, such as petroleum, water-gas, creosote or tar, etc., and, what I call, a physical determination or fractionation, to determine the relative amounts of low and high boiling quantities.

The fractionation has for its object the determination of the per cents of low and high boiling fractions. It is not a chemical method in the exact sense of that term. So much has been written about fractionation that I can add nothing new. The present American Railway Engineering Association method was recommended for the purpose of having a standard. I have repeatedly stated that it makes no difference what method is used as long as everybody uses the same method.

Arrangements of Yards and Piling Ties at Treating Plants.

J. H. Waterman.

In the beginning I wish to state the entire layout, shown in the drawing (herewith) has been worked out on a practical basis and in accordance with standard track devices. The proposed layout is an evolution of the present track layout of the Galesburg plant, C., B. & Q. R. R., and covers 95 acres, with 10½ miles of track.

The arrangement is general and can be extended or contracted either in width or length. The object has been to make switching operations simple and convenient. The switching leads are independent and do not interfere with or block movements on any other tracks. There are two leads so that switching can be done from either end of the yard tracks. Thus only one-half of a string of cars need be handled at one time, and this operation does not block any operations on the other half of the tracks. There is a running track between the leads which is to be kept open. The yard has been designed with the object in view of having "a place for everything and everything in its place."

All tie storage tracks are made three rail, to accommodate both standard and narrow gauge equipment. This allows the switch engine to move long trains of trams whenever desired. Timber and pile storage tracks are laid out in parallel pairs, one standard and one narrow gauge track. This arrangement gives a clear track for the use of a crane, which should be used in handling this class of material. The piles and lumber are to be located in the center of the yard, so that they will travel as nearly on tangent as possible when moving into the treating cylinders.

After the trams are unloaded, they drop back into the yard along the lead nearest the plant. The running track is straight and located in the center of the yard. Loads and empties are handled without waste movements. Three rail tracks save space and rails as compared with two tracks.

When unloading a train of ties, start from the lead and work toward the center of the yard. Then start from the opposite lead and clean up the track. In this manner all empty cars are near the lead and may be moved out by the switch engine at any time without delaying the laborers.

The tie tracks are located on 100 ft. centers, and 20 ft. clear fire space is left between the piles of ties along adjacent tracks. When we have few ties and many men we make the stacks high, but when we have lots of ties and few men we make the stacks lower. The piles are made in 1 to 8 stacks.

There are three hold-over tracks for loaded trams, and it is planned to keep a number of trams above those ordinarily required. These can be kept loaded to take care of fluctuation in the demand of the cylinders, labor supply or labor output. For loading, a raised platform or depressed pit may be used as desired. The depressed pit has disadvantages, unless very good drainage can be provided.

Treating Seasoned vs. Unseasoned Ties.

By F. J. Angier.

Naturally, the first question which would arise in a subject of this kind is, what is a seasoned tie? When we speak of an unseasoned tie, we mean one freshly cut, or, at least, one that has been recently cut and has lost but a very small amount of the moisture which it originally contained; in other words, the sap-wood is so completely filled with moisture that it would be impossible to thoroughly treat the

Method of Piling Ties.

tie until this moisture had been at least partially removed. A seasoned tie, therefore, is one that has been cut for some time and the moisture allowed to evaporate to a greater or less degree. Oak ties, in Illinois, must be air-seasoned six months or more, according to the time of year, before they can be properly treated. Some kinds of ties may be seasoned in three or four months.

For the purpose of illustration, and as a basis for argument, we will assume that it requires six hours to treat a charge of thoroughly seasoned ties and nine hours to treat a charge of unseasoned ties. In other words, it requires one-half longer time to treat unseasoned ties (card process). Of course, the time may vary one way or the other, but we found this to be a fair average.

Assuming this to be correct, your attention is respectfully called to the two tables following, one showing the cost of treating in a plant having a maximum capacity of 1,800,000 seasoned ties a year, and the other the cost of treating in the same plant, where the maximum capacity is reduced to 1,200,000 unseasoned ties a year.

Seasoned Ties.

Capacity of Plant 1,800,000 Per Year.

Unloading from cars to ground to season at $0.0070 each	$ 12,600.00
Loading from ground to trams at $0.0055 each	9,900.00
Switching trams at $0.0020 per tie	3,600.00
Loading treated ties out at $0.0065 each	11,700.00
Fixed expenses	23,268.00

Preservatives at 15c. per tie	270,000.00
Fuel (assume 1-3 less for seasoned over unseasoned ties)	5,600.00
Insuranced carried on 1,000,000 ties (estimated)	4,000.00
Interest on 1,000,000 ties for six months, or 5 per cent on $250,000	12,500.00
	$353,168.00
600,000 more seasoned ties treated than unseasoned, worth $0.044 each (see statement)	26,400.00
	$326,768.00

$0.1815 per tie.

Unseasoned Ties.

Capacity of Plant 1,200,000 Per Year.

Unloading one-fourth from cars to ground to enable prompt releasing of cars, at $0.0070	$ 2,100.00
Loading 900,000 ties from cars to trams at platform and 300,000 ties from ground to trams at $0.0055	6,600.00
Switching 300,000 ties from yard to retorts at $0.0020	600.00
Loading treated ties out at $0.0065 each	7,800.00
Fixed expenses	23,268.00
Preservatives at 15c. per tie	180,000.00
Fuel	8,400.00
Insurance carried on 300,000 ties (estimated)	1,200.00
Interest on 300,000 ties, or 5 per cent on $75,000	3,750.00
	$233,718.00

$0.1948 per tie.

In each case the total cost of handling is shown from the moment the ties are received at the plant until they are loaded into cars for shipment.

In the case of fixed expenses there are included the salaries of the superintendent, general foreman, office force, engineers, firemen, etc., that is, all labor which would not change one way or the other, whether treating seasoned or unseasoned ties. This amounts to $0.0129 per tie when treating 1,800,000 ties per year, and $0.0194 when treating 1,200,000 ties per year.

In the case of seasoned ties, where no steaming is done, it is assumed that insurance is carried on 1,000,000 ties for six months and that $250,000 will be continually invested at 5 per cent. In the case of unseasoned ties, we must assume that at least 300,000 will always be in the yard. This stock is necessary to provide against delay to plant at certain times of the year, when traffic is so great that company material cannot be moved with regularity. Also, at certain times of the year, ties will be received faster than they can be treated, necessitating the storing of a portion of them.

It is shown in the table that a treated tie is worth $0.044 to the company. This is obtained as follows:

Untreated Ties.

First cost	$0.50
Cost of putting in track	.15
Cost of tie in track	$0.65
5 per cent interest on investment for six years	.195
Second renewal, end of six years	.65
5 per cent interest on first investment for six years, and on second investment for six years	.39
Total cost of tie for period of 12 years	$1.885
Average cost per tie per year	$0.157

Treated Ties.

First cost	$0.70
Cost of putting in track	.15
Cost of tie in track	$0.85
5 per cent on investment for 12 years	.51
Total cost of tie for 12 years	$1.36
Average cost per tie per year	$0.113

Saving per tie per year $0.044.

Untreated ties are assumed to last six years, and treated ties twelve years.

Assuming this to be reasonable, and that 600,000 more ties per year can be treated when thoroughly seasoned, deduct from the cost of seasoned ties the difference between 1,800,000 ties and 1,200,000 ties, or 600,000 ties, at $0.044 each. We have a difference of $0.0133 per tie in favor of treating seasoned ties. This multiplied by 1,800,000, the number of seasoned ties treated per year, represents a saving of $23,940 in favor of seasoned ties.

In addition there would be a better penetration of the preservatives; therefore a longer life obtained for the ties and the lessened possibility of injury to the wood by steaming. When steaming there is always a large amount of sewage to dispose of, while in non-steaming there is practically none. The disposition of sewage is a difficult problem at most plants, because no matter how it is handled some of it will get into the rivers or creeks and pollute the water to such an extent that damage suits may result. This is entirely avoided when using seasoned ties.

Inspectors and Inspection of Material and Treatments at Commercial Plants.

By R. L. Allardyce, Texarkana, Texas.

Raw material should be inspected at the saw mill or tie and piling camps, as inspection of material at the plant works a hardship on the operators. While the treating companies may have their own inspectors taking up the material, you will find that no two inspectors will take the same view of a piece of timber, and especially is this so in piling; one may consider a small defect of no consequence and accept it to have it later thrown out by the purchaser's inspector, who might take one that had some other defect in it.

If the material is shipped subject to inspection at the plant the culls will have to be contended with, as well as differences with the shippers. I have found that taking care of the rejects will entail as much, if not more, expense than handling the same amount of material through the retorts; you have to keep them separate, mark each piece with the car number that it came from and stack it away properly; then when the shipper comes along handle it again for him, showing the defects.

This expense incurred is generally left for the plants to bear. Then, again, if it is left to plant inspection and you get a cull or reject on the last car of the order, you will have to hold up the order until you can replace the pieces on some other car coming in to the plant.

We have a small saw mill at our Texarkana plant to try and take care of the culls, but on large timbers we generally have to hold up the order until we can replace them as above.

I am of the opinion, when an order is of any size or consequence, the plants should request an inspector at the origin of the material, as well as an inspector of treatment at the plants. In this way lots of trouble and dissatisfaction with the plant would be eliminated.

As to the inspection of treatments I will not say much, as you well know there are two kinds of inspectors—those that inspect and those that don't. Of the latter I will not say anything, as I have found them a nuisance.

I admire a man that attends to his duties, and am always willing and anxious to show him around. Of course, we do this for both kinds; but I want to say now, if he is the right kind, you will have to show him; he will watch all gauges, run his own analysis of oil or preservative, take his own temperatures and figure his own charges independent of the plant's. While we have recording gauges, etc., in our retorts, I like to see them come in and check them. If they have a set of specifications to work to, even though I would not consider them absolutely correct, I find that it is best

to comply with them when possible, otherwise frankly tell them that we cannot do so, explaining to them fully why we can not. This gives the inspector a chance to take it up with his people and get action on it, as the inspector cannot be blamed any more than we can for freak specifications.

When possible we have the inspector check all out-bound shipments so as to be sure of a correct tally at destination, and after following his specifications we feel that we should have a satisfied customer, and that is what we are all after.

Give me an inspector that is on the job all the time; one that takes an interest in his work and knows his business, and when he is through I can feel that I have done my best, and if the treatment does not stand up they will not have the plant end of it to blame, but their specifications.

Preservation of Power Transmission Poles.

By W. R. Wheaton.

In March, 1908, the San Joaquin Light & Power Corporation set a line of western yellow pine (pinus ponderosa) poles about thirty miles long and containing approximately 600 poles. A portion of the poles were given a brush treatment with carbolineum and with creosote, and the balance were treated in the open tank with creosote, zinc chloride and crude oil. The butt only was treated. Western yellow pine is very suspectible to a preservative treatment. Some of the butts were thoroughly penetrated with creosote and with zinc chloride, the average penetration (at the ground line) being three inches. The penetration with crude oil averaged about one and one-half inches. The crude oil used was a heavy oil of asphaltum base supplied from the Kern river fields. In order to get a comparative life of the wood treated and untreated, stubs of untreated timber were set along the line about a mile apart. The writer inspected this line in June, 1910, at which time it had been set for twenty-seven months. The untreated stubs set along the line were completely rotten. Of the poles brush treated with carbolineum and creosote, the conditions were about the same, a large per cent of each showing signs of decay; 27 per cent of the poles given a brush treatment with creosote showed signs of decay, and 29 per cent of the poles given brush treatment with carbolineum showed decay; 45 per cent of the poles treated with crude oil were slightly attacked by decay. Of the poles treated with zinc chloride, 28 per cent showed attack by decay. The poles treated with creosote in the open tank (over 50 per cent of the entire line was treated in this way) were all perfectly sound, and showed absolutely no signs of decay.

In closing, I would like to say a word regarding the choice of a preservative. I have been asked many times why we do not use zinc chloride, copper sulphate, or some preservative other than creosote, to cut down the treatment charges. The San Joaquin Valley is a hot, dry country throughout nine months of the year, and it would seem that chloride of zinc would make a very efficient preservative. The line of yellow pine poles mentioned above runs through a large area of such undeveloped country. Inside of a year after the erection of the line wells were driven, irrigation systems were installed, and a large percentage of this undeveloped country was planted to oranges. It was found that several of the poles treated with chloride of zinc were set in this portion of the line, and after the installation of the irrigation systems these poles were in the middle of irrigated fields, the zinc was washed out of them, and the poles had to be replaced after a service of two years. A 50-ft. creosoted pole placed in the line means an investment of about $25.00. The use of chloride of zinc would cut this cost to about $24.25, and it can readily be seen that the saving is too small to be considered against the possibility of the loss of the preservative in a matter of one or two years.

Wood Structure and Its Effect on Treatment.

Howard F. Weiss.

There are many ways in which the field of wood preservation may be enlarged. First, in the way of fireproofing. A treatment which will preserve wood and also protect it from fire, would be a valuable one. There is also another field, that of giving wood properties which it does not naturally possess, or to imitate expensive wood. A process which will harden soft wood, would also be a very valuable one.

There are a number of factors which very directly affect preservative treatment; the character of the cells in the wood, resin ducts in cells, moisture, bark, and percentage of heart and sapwood. Classified according to cell structure, there are three kinds of wood: (1) that with the fibres longitudinal; (2) that with the fibres circular (ring porous); (3) that with no fibers. With the first the penetration of preservative must be mainly from the end of the stick, with the second mainly from the sides of the stick. With third class it is almost impossible to obtain a good penetration.

It has been found that the heavier portions of woods, the summer growth, treat easiest. We account for this fact in that the heavier wood cell walls split open more in seasoning than the lighter wood cell walls. If a method of splitting the cell walls can be discovered which can be used commercially, the white oak can be successfully treated.

Water occurs in wood (1) in cells, (2) in the cell walls. The cell water is exhausted first. The water in the cell walls greatly increases the strength of the wood.

There are several theories of the behavior of the air in wood, when it is subjected to the action of a preservative under pressure. These are: (1) the compressed air gathers in a number of pockets throughout the wood; (2) the air is compressed in each individual cell; (3) the air escapes and rises to the top of the retort; (4) the air forms a pocket near the center of the tie.

We have made a number of tests and have been unable to collect any air from the top of retorts, which shows that the theory that air escapes is wrong. If the air gathered in the center of the tie, no preservative could be forced into the center, and this has been disproved in practice. Our experiments tend to show that the air is compressed in each air cell.

Some tree barks are infiltrated with a waterproofing substance which can scarcely be pierced under a pressure of 500 to 600 lbs. When treating a wood where the penetration is through the sides, the bark must be removed very completely, as a film 1-16 in. will prevent penetration. However, with a wood which is penetrated from the end, the presence of bark is not so injurious.

Committee Report.

A committee of which C. M. Taylor was chairman, reported on specifications for zinc chloride and creosote. Zinc chloride specifications were drawn up and presented in printed form. The report stated that creosote specifications could be considered under either or both of two methods i. e., (1) analysis; (2) fractionation, or distillation.

A motion was seconded and carried to submit the specifications for zinc chloride to a letter ballot, to increase the committee to five members, and to instruct it to continue the work.

The following are the newly elected officers for 1912:

President—E. A. Sterling, Forester, Penna. R. R., Philadelphia, Pa.

First vice-president—A. M. Smith, Supt. Ayer & Lord Tie Co., Argenta, Ark.

Second vice-president—H. M. Rollins, Superintendent Gulfport Creosoting Co., Gulfport, Miss.

Third vice-president—Grant B. Shipley, President Pittsburgh Wood Preserving Co., Pittsburgh, Pa.

Secretary-treasurer—F. J. Angier, Supt. Timb. Pres., B. & O. R. R., Baltimore, Md.

The name of the association was changed to the American Wood Preservers' Association. The next meeting will be held January 1913, in Chicago.

— NIGHT EDITION —

The Engineer's Distress.

A.S.GUNN. ED. VOLUME I. CHICAGO-ILL. No.II. A.S.GUNN. DEL.

THE WEATHER.

Much warmer in a Pullman car, than when walking the ties.

It grew very hot yesterday when Bonehead the tapeman, let the axe fall on the transit. The predictions are that it will be much hotter tomorrow when the Division Engineer hears of it.

SUGGESTION FOR TAPEMEN WHO WISH TO BETTER THEIR EFFICIENCY

ALWAYS - Give the chain a quick jerk when you see a kink in it.

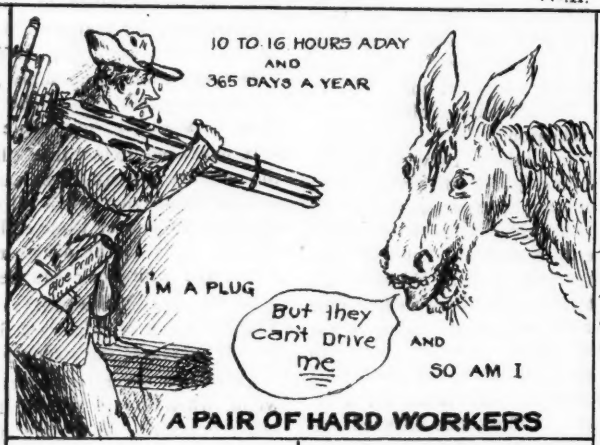
ALWAYS - Give the the stake one more blow with the sledge after the instrument man said right.

ALWAYS - Remember to kick over your T.P. after the instrument man has pulled up.

ALWAYS - Leave the chain lying across the track when you go to lunch.

ALWAYS - Be boisterous and talk as loud as you can when you come in to the office, as it will help to keep the draftsman awake, and make the office appear more like a boiler shop.

CONTINUED IN NEXT ISSUE.



A PAIR OF HARD WORKERS

H.I. SLIMBELLY.

We again called on our old friend H.I.Slimbelly and to our surprise we hardly knew him. He had grown so fat, since his reduction in 1907; In fact his whole appearance had changed wonderfully. He seemed very jovial and talked more like a financeer than an engineer, for by his side lay a sack of money which he informed us was refused by the banks as they had limited space and could not handle such large amounts. Good Work Slimbelly.

THE SUNSHINE CLUB

The Sunshine Club opened this morning in the usual manner and all were greeted with a smile from H.I.Slimbelly. We were all so glad to see him back again among the ranks. H. I. Slimbelly has fully recovered from the panic of 1907 and is now awaiting with patience the return of another. He isn't used to working so steady anyway, and I fear the result may make him sick.

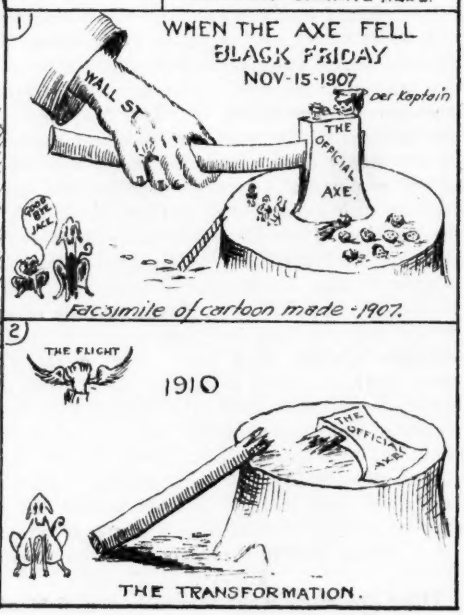
KEEP SMILING.

EDITORIAL

During the panic of 190(?) our editor was so reduced that another issue of the Distress was doomed, but being founded in the reign of prosperity its issue was ineritable. So here we are ready to discuss the crime of over-eating which we touched upon in our last issue.

When we called on our friend H.I.Slimbelly we hardly knew him Why? Had he been overeating or had he swallowed an olive? Prosperity has been here some time and it is possible that our friend "Slim" has had a tendency to "fall" for the "bright lights about twice a

CONTINUED COLUMN 2. PAGE 2.



Facsimile of cartoon made - 1907.

RAILWAY ENGINEERING
AND MAINTENANCE OF WAY.

THE ENGINEER'S DISTRESS

The Distress.

FOUNDED IN THE REIGN OF PROSPERITY.

A MONTHLY ENGINEERING JOURNAL FOR BROTHER ENGR

You make quite a lot of money in this business, said the farmer, who was watching the instrument man adjust his transit.

Yes, replied the instrument man, a smile stealing across his face, after I have paid all my expenses I have enough left to buy a postal card to send the folks back home.

ED. NOTE. MORE TRUTH THAN POETRY IN THIS.

month and thereby separate himself from a few small coins of his hard earned wages. by partaking of the repast consisting of lobster a la Newburgh or some other delicious dish as, well we wont specify them here at present.

Now is it right for any poor engineer to depart from his regular line of "Coffee and," "Rolls and," and eat until his porch is so distended as to fool his friends such as our friend H. I. Slumbelly has done? This is a serious question and we do not think it is right for an engineer to even "knock off" at noon or stop his work to eat.

IF BUSINESS INTERFERES WITH YOUR EATING, QUIT YOUR BUSINESS. ED.

POEM

For many years I have worked in vain,
Striving and struggling thro snow and rain,
To reach the goal we all would attain,
But this morning the Boss said
BEAT IT.

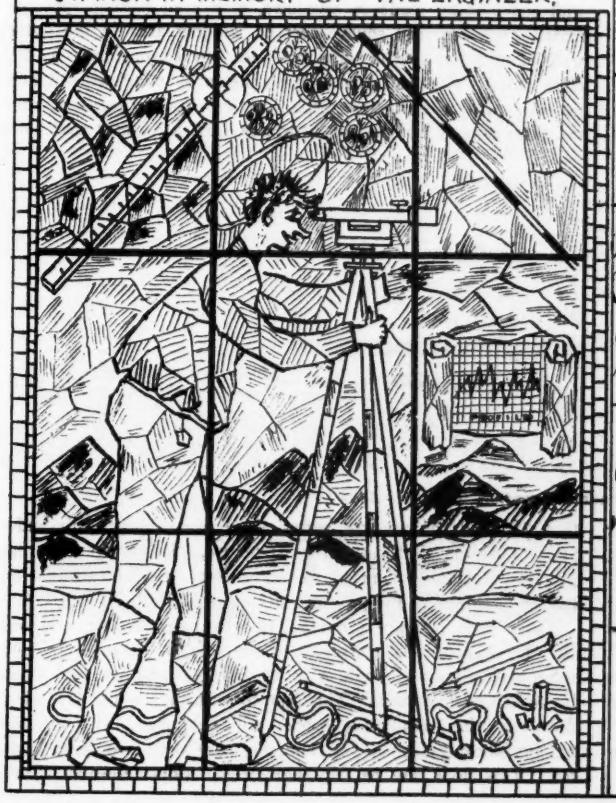
Next morning I looked with might & main
For a job where I could be in out of the rain
So I hired out as draftsman to try my luck again
But one morning the boss said
BEAT IT.

Hungry and tired with nothing to do
I stepped into a free lunch joint to get
something to chew
I stood there eating till half past two
But suddenly the bar-keep said
BEAT IT.

An exact reproduction from photograph of the cigar which was handed to one of our assistant Engineers by one of the firm of contractors (Boodle and Soakem) as an attempted bribe while they were grading on Section no 1 just North of Sleepy Hollow. Young man, take warning never accept a cigar from a contractor. Make him give you a box, anyway.

Contractors take notice.

WINDOW DESIGN FOR NEW TERMINAL STATION IN MEMORY OF THE ENGINEER.



This Engineer wants a job merely to wear out his old clothes. This ad clipped from a well known Engineering Journal, explains one reason why Engineers receive such poor wages. Burglary may be this mans real profession.

GRADUATE civil engineer, ten years' experience in drafting departments of leading firms, all classes steel structures and bridges, seven years in present position, desires change moderate salary. Address "R."

SAN GABRIEL MISSION.

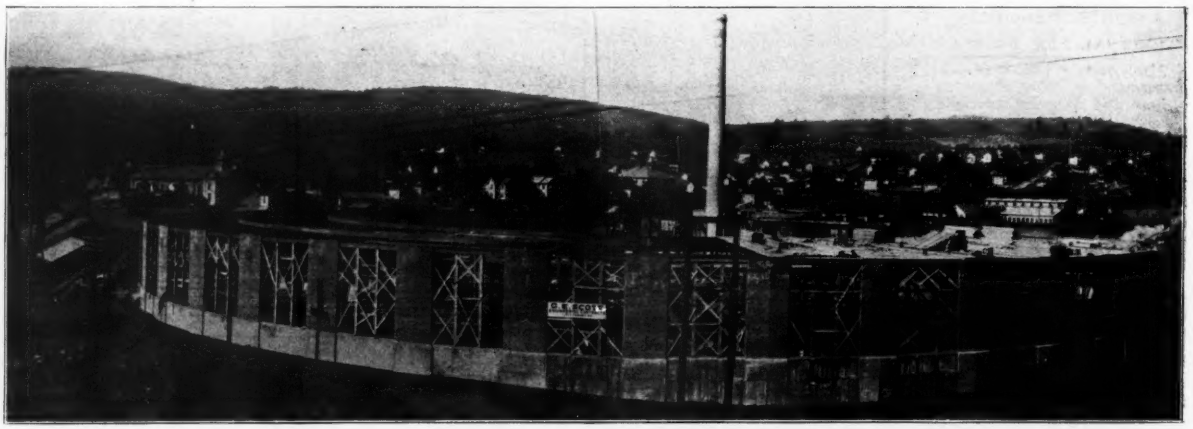
Postal Card received by the office force from H. I. Slumbelly, Asst Engr, who in eighteen years service on a R.R. was able to get two weeks vacation and was able to save enough money to defray expenses.

Carbondale Roundhouse, D. & H. Company.

The Delaware and Hudson Company is just finishing the construction of a round house at Carbondale, Pa., for the housing of its Mallet locomotives, and has made a number of other improvements greatly enlarging the facilities and bettering the conditions at this point. Carbondale, in the heart of the anthracite coal fields, is the division headquarters of the Pennsylvania division and its principal yard point, from which an extremely heavy tonnage goes out daily both to the north and to the southward. The new Mallets are employed to bring in shipments from the lower portions of the division, but especially are they effective in the pusher service to the summit of Ararat, north of Carbon dale.

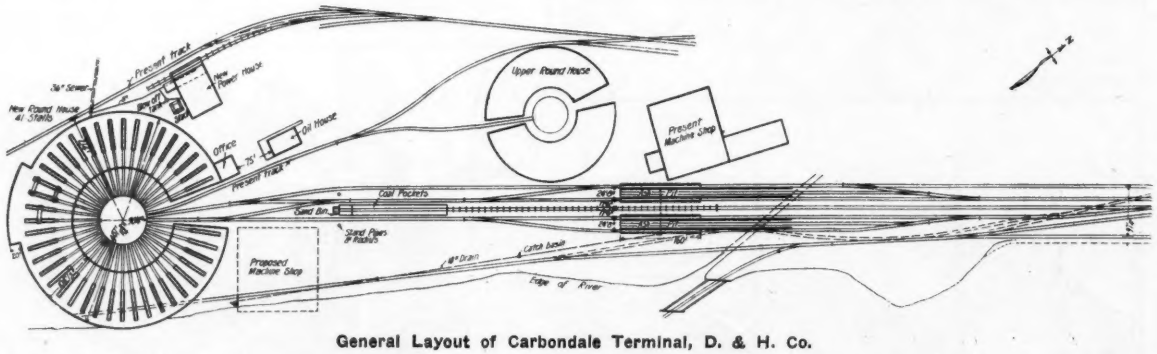
Until the recent improvements, the shop facilities at Carbondale consisted of a machine shop, car repair shops, coaling station, etc., and two round houses, one built about 1884, and the other a larger one of more recent construction, but neither of sufficient length of stall or turntable capacity to permit their being used for housing the new power equipment secured to the increasing amount of heavy traffic. This class of locomotive is amply provided for, however, in the new roundhouse located south of the present machine shops between the local freight yard and the Lackawanna river, and over the site of the older of the two original structures, the south roundhouse, which was torn down and removed during the progress of the new construction this season. To provide the necessary space for this building and the other improvements, the car repair shops are now all located on the east side of the river, the old ash pit is removed and two new double pits built a short distance from the present machine shops and near the northern approach to the new engine terminals. Also a portion of the old classification yard was taken up, a rearrangement of portions of the trackage in the yard being contemplated.

The new structure is a forty-one stall house, the inner circle having a diameter of 199 ft. 8¾ in., the outer diameter being 407 ft. 11¾ in., giving a stall depth of 104 ft. 1½ in., adequate for the largest locomotives in the service of this company, or contemplated for this division. The foundation and substructure is of concrete, the concrete extending to the top of the water table at a height of four and one-half feet above the elevation of the finished floor. The superstructure is of brick with steel columns and roof girders, provision having been made in the plans for a concrete protection encasing the steel work. The roof, supported on the steel structure by heavy wooden purlins, is constructed of two-inch matched spruce sheathing over which is placed a five-ply slag covering.



View of Carbondale Roundhouse Under Construction, D. & H. Co.

A commendable feature of the design is the generous provision made for natural light, a very large percentage of the wall space being made of windows, each stall having approximately four hundred square feet of window area in the outer wall in addition to the windows and louvred openings in the clere story. The wall space under the large windows is taken up with a reenforced concrete slab carried upon projections from the piers supporting the brickwork, in such a manner that both this slab and the window series above it are practically independent of the roof supporting structure, eliminating as far as possible danger of damage to the general structure should an engine run beyond the pits into the outer wall.



General Layout of Carbondale Terminal, D. & H. Co.

Three drop pits are provided, two for pony trucks, and one for the drivers, while directly to the rear of these drop lean-to for machine tools which is 20 ft. deep and extends along the width of five stalls. This lean-to will have a standard shop floor, but the roundhouse proper will be floored with vitrified paving block laid on a 5-in. concrete base with 2-in. sand cushion. This floor will be laid with proper slopes towards catch-

basins, of which there are three to each stall, these in turn communicating by vitrified tile drains to the main drainage conduit and thence to the main trunk sewer leading to the river. This conduit is reenforced concrete, and receives also the roof drainage, this being carried in cast iron conductors to the floor line, and in tile lines below the floor. The brick floors

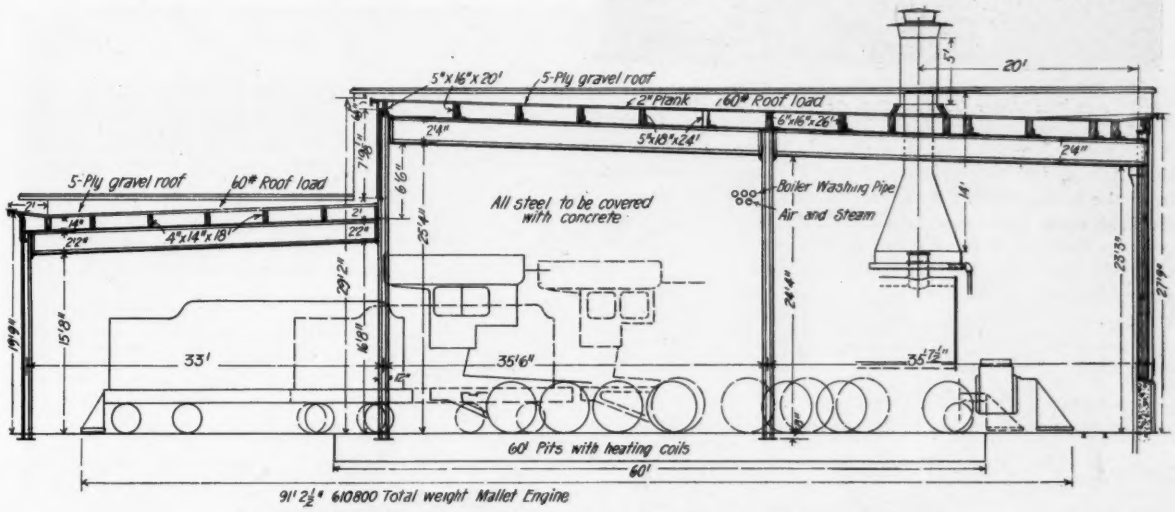
End of Carbondale Roundhouse, Showing Partially Completed Rest House, Oil House at Right.

are arched slightly between the rails of the tracks to the pits, but laid level between the rails of the 24-in. track, which, to facilitate repairs, follows the entire circumference of the outer circle between the end of the pits and the outer wall.

The cast iron smoke jacks used were made by Paul Dickinson, Incorporated, Chicago. The building is heated by a direct system with coils along the pits and walls, the mains being carried in the concrete conduit around the inner ends of the engine pits. The boiler washing system was installed by the National Boiler Washing Company, of Chicago, the mains of this system, together with the air pipes, being carried on supports suspended from the steel roof girders, with drops at every other column.

Attached to the roundhouse is a rest house and locker room for the engineers and trainmen, and the upper stories of this same building will serve as offices for the master mechanic and his supervising force. This building has concrete and brick walls, closely following the lines of the roundhouse design, and will be completely equipped for the convenience and comfort of the employes while at the same time providing for the expeditious handling of the business of the department.

The oil house provided is a two-story reenforced concrete structure with brick exterior walls above the second floor, but with concrete floors and roof, all windows being protected by heavy wrought iron shutters and the doors all tin-lined. The



Section of Carbondale Roundhouse, D. & H. Co.

building is surrounded by a platform on two sides and contains a very complete system for oil distribution furnished by Gilbert & Barker.

Near the roundhouse is located the new power plant, which is housed in a concrete and brick structure approximately 66x90 feet in size, with roof of construction similar to the round-

Inner Circle, Carbondale Roundhouse, D. & H. Co.

The roundhouse is served by a ninety-foot, cone-roller center turntable made by the American Bridge Company, and equipped with a Nichols electric tractor. The turntable is mounted on a reenforced concrete foundation sunk to hardpan, and the pit is walled and paved with concrete.

house, supported on steel girders. The boiler room at present contains 800 H. P. of Babcock and Wilson boilers, with foundation space provided for double this capacity in the present building, while for future needs, ground space is reserved for the extension of the entire building to the north. The boilers

are served by a reenforced concrete chimney built by the General Concrete Construction Co. The engine room adjoining the boiler room contains the air compressor and blower equipment, with an ample capacity traveling crane; while in the pump room below is installed the general pumping equipment and the tanks and equipment incident to the boiler washing system. All the floors in the power plant are of concrete or reenforced concrete.

Fuel for the boilers is delivered to the bunkers at the powerhouse by gravity from hopper cars spotted on the trestle over

Ash Pits Under Construction, Carbondale Terminal.

the bunkers, and the ashes are handled by special equipment from the tunnel below the fireboxes to empty cars on this same elevated track. For coaling engines the new coaling tipple of large capacity is constructed of wood on concrete foundations, the light grade of the long trestle approach to the bins greatly facilitating the ease of placing cars over the bins. Special measuring pockets will be used for the coal. Sand storage bins with drying house will be reached by this same elevated track.

The water supply and fire protection are afforded by the city system.

Construction View of Coaling Plant, Carbondale Terminal, D. & H. Co.

The work was done by G. E. Scott, of Pittsburgh, under the supervision of V. Z. Caracristi, consulting engineer for the Delaware & Hudson Company.

The St. Louis & San Francisco proposes to build a new passenger station at Ada, Okla.

The St. Louis, Brownsville & Mexico has let the contract for a new tourist hotel and a new passenger station at Kingsville, Tex. Work is now in progress on the enlargement of the shops at this place.

It is reported that the Southern Pacific will start work in the Spring on a new passenger station at Sacramento, Calif., to cost $350,000.

The Texas & New Orleans will shortly begin the erection of a new roundhouse at Beaumont, Tex.

BUSTING THINGS UP.

There was a fellow got a hunch
That he was strictly "It,"
Just to get even with his boss
He quit.

The boss he bore it wondrous well,
He never wailed or moaned or swore;
But said, "As you go out don't slam
The door."

The other boys about the place
Did not go moping much that day.
They laughed and said good-bye, and drew
Their pay.

He thought: "They do not realize
That I have left them to their fate.
So much the better; let them laugh;
But wait!"

And then he ambled down the street
And confidently told the town:
"Now, fellows, watch and see the boss
Fall down."

Somehow or other, things went on;
The business did not go to smash;
The boss went smiling as he grabbed
The cash.

And every day the fellow met
Some friend who didn't know he'd quit,
And didn't care, and wasn't sore
A bit.

It rather stunned him that the world
Went booming on through day and night
As well as when he used to keep
It right.

Somehow there isn't any man
For whom the whole creation squirms;
And good men cluster round a job
Like germs.

And when you up and leave your place
And think the whole blame works will quit,
The joker hollers, "Tag, old man,
You're it!"

The world goes plugging, plodding on,
As unconcerned as it can be;
If you are mentioned some one asks,
"Who's he?"

—*St. Paul Dispatch*

Macon Shops, Central of Georgia Ry.*

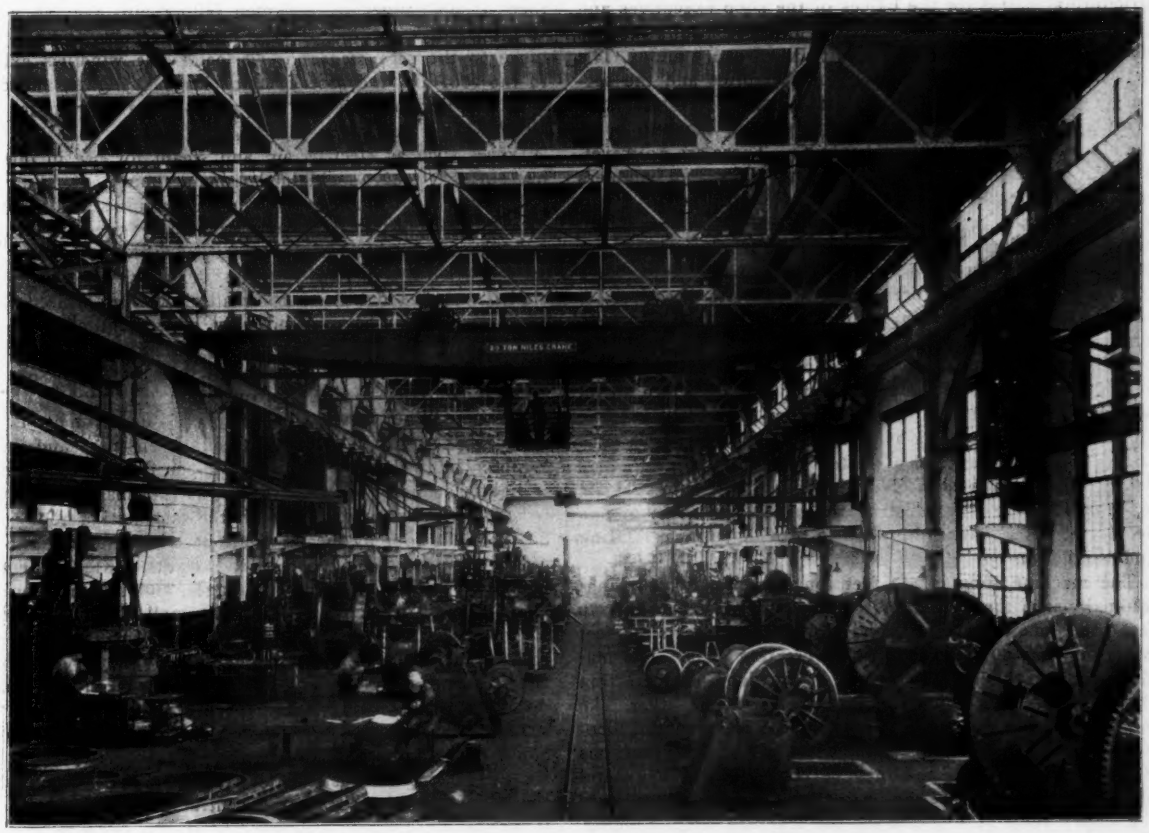
The Central of Georgia Ry. operates three shops, one at Savannah, one at Columbus and one at Macon. The Macon shop has been completed and in operation a few months. The old shop at Macon occupied the same site as the new one and every effort was made to continue operations without delay while the new buildings were being erected and the machinery installed. The buildings are grouped to facilitate what inter-communication is necessary and to employ the ground space to the best advantage. In planning the lay-out of the buildings especial attention was given to ease and economical handling of material. The buildings are of steel and brick construction, with slow burning wooden roofs, the general design being clearly shown in the accompanying illustrations. The windows are large and numerous so that plenty of light is to be had at all times.

The power plant is located at about the center of the shops. The slope of the land is such that an exceptionally deep basement could be obtained without raising the engine room floor to an undesirable height above the general grade of the rest of the plant. Five 250-horsepower Stirling boilers are installed with an underground flue leading to the stack which is 9 feet in diameter and 175 feet high. Coal is delivered to the boiler room direct from cars on an elevated trestle and a narrow gauge railroad is provided for removing the ashes. Suitable provision is made for the installation of additional equipment in case it is needed.

The engine room contains two 300 k. w. and one 500 k. w. Westinghouse turbines direct connected to alternating current generators, a Corliss cross compound Chicago Pneumatic Tool Company air compressor with a capacity of 2,000 feet of air a minute and the necessary auxiliary apparatus. The air compressor is direct connected to a fore-cooler from which piping conducts what air is needed to the various shops. The entire water supply is obtained from a private pumping station located on the Ocmulgee river about a mile from the plant. This plant was described on page 113 of the *Railway Master Mechanic* for April, 1910. An interesting feature is that the pumps, located at that river, are motor driven and directly controlled from the switch board in the power plant. The only attention given them is an occasional inspection and renewal of the oil for the bearings of pumps and motors. The buildings are equipped with an abundance of artificial illumination by means of Cooper-Hewitt mercury vapor lamps and portable incandescents.

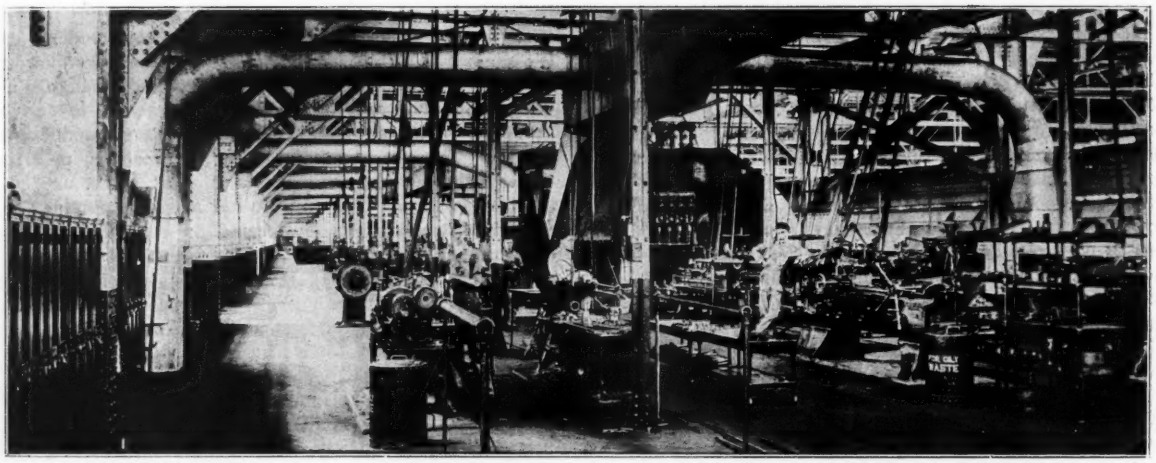
The compressor and turbines may be run either condensing or non-condensing as desired. This enables the use of exhaust steam in the winter for heating purposes. The auxiliaries are steam driven and the exhaust used for heating the feed water. The auxiliaries, except the vacuum pumps, are located in the basement. The plant is provived with fire protection by means of a 1,000 gallon fire pump, located in the basement of the power house, and a 50,000 gallon high pressure elevated tank erected near the power house. In case of emergency the service pumps at the river can be used for fire fighting.

The master mechanic's office is a substantial red brick



General View of Macon Machine Shop, Cent. of Ga. Ry.

* The illustrations published with this article were obtained by courtesy of the editor of Southern Machinery, Atlanta, Ga., which journal printed a similar article in its November issue.



Balcony of Macon Machine Shop, Cent. of Ga. Ry.

structure arranged for the offices of the shop executives and general clerical force of the works. The blacksmith shop is 100 feet wide and 260 feet long with a two-story annex. The first floor of the annex is used for lavatories and the second floor for housing the volume and pressure blowers supplying air to the forges. A general view of the interior of the blacksmith shop is shown herewith. There are no traveling cranes installed, but the different forges and hammers required for heavy work are served by revolving jib cranes which also reach the narrow gage industrial railway shown in the illustration. The forges for light hand work are set at an angle in two rows down the center of the shop. Each forge is double with the fires facing in opposite directions.

The blast is furnished by a blower located in the annex. The machines such as rod heating furnaces, bulldozers, bolt machines and hammers are located around the building wall near the windows and the furnaces for this work are all oil burners obtaining the air pressure from the blowers in the annex. In this illustration is shown a 3,000 pound double frame steam hammer and a 400-ton steam hydraulic forging press. This shop is connected with the storage yard and the machine shop by the industrial railway. A monitor roof is provided for the blacksmith shop to provide suitable lighting and ventilation.

The machine shop is 510 feet long, and is divided longitudinally into three sections; one for the machine shop, 70 feet wide; one for cleaning and storage small parts, 45 feet wide; and one 60 feet wide for an erecting shop. The machine tool arrangement is shown in drawing. The erecting shop contains two crane runways, one above the other. The upper one carries a 120-ton crane, used for lifting the locomotives and other heavy work, while the lower crane has a capacity of 10 tons and may be considered as a general utility crane. The lower runway extends uninterrupted into the boiler shop at one end of the machine shop building. Thus the lower crane is able to transfer boilers, tubes, cabs, etc., from one shop to the other without rehandling.

The locomotive stalls are on 13 foot centers, thus leaving sufficient room between locomotives being repaired, for the workmen. Just back of the erecting floor a number of tanks are embedded in the floor, containing lye water for removing the grease and dirt from the parts stripped from the locomotives. These tanks are equipped with drainage and steam pipes for heating the lye water. After cleaning, the parts are washed and stored in the storage space until they are again wanted. Heavy wooden covers are provided for the lye tanks so that the whole floor is available and there is no danger of workmen falling into the lye water while passing to and fro. The floor is cement and the distance to the roof girders is 50 feet. The windows extend to the roof and the roof contains large skylights, affording excellent light during the day and seldom if ever are the electric lights required.

Power such as electric, air, and steam for use in operating portable tools is obtained from a tunnel extending the full length of the shop in front of the engine stalls. Wiring for portable electric lights such as are required in the pits and boilers is also laid in this tunnel, as well as the piping for oil. Provision is made by means of service boxes at each stall for cutting out any one or all circuits as desired. This arrangement has been found very convenient as each engine can be repaired independently of those in the immediate neighborhood and no time is lost in waiting for another repair crew to finish an operation.

The lower floor of the storage space is used for fitting engine driving boxes before wheeling engines, and other medium heavy hand work. The upper floor is given over to light machinery operations, such as tool manufacture, and is in direct communication with the distributing tool room on the main floor by means of an electric elevator. The repair departments for electrical apparatus, air brake equipment, injectors, lubricators and gages, and the tin shop are also located in this balcony. Two small electric elevators are provided for lifting material from the main floor to the balcony. The balcony is very completely equipped for the work to be done there and would excite the envy of many owners of shops doing small and medium sized work.

The main machine shop is well arranged with tools ranged along the sides of a main passage way down which is laid the tracks of the industrial railway. The power required in this shop is generated in the central power plant and all tools are either direct connected to electric motors or operated from short line shafts in groups. The larger tools are all direct connected to electric motors equipped with suitable starters and speed controllers. This shop is well provided with cranes for handling work on the floor and at the machines. An interesting feature in connection with the engine wheel lathes is that the speed of cutting is automatically regulated according to the hardness of the tire being turned. This is regulated by a series of switches, shunts and resistances governing the current supplied to the motors.

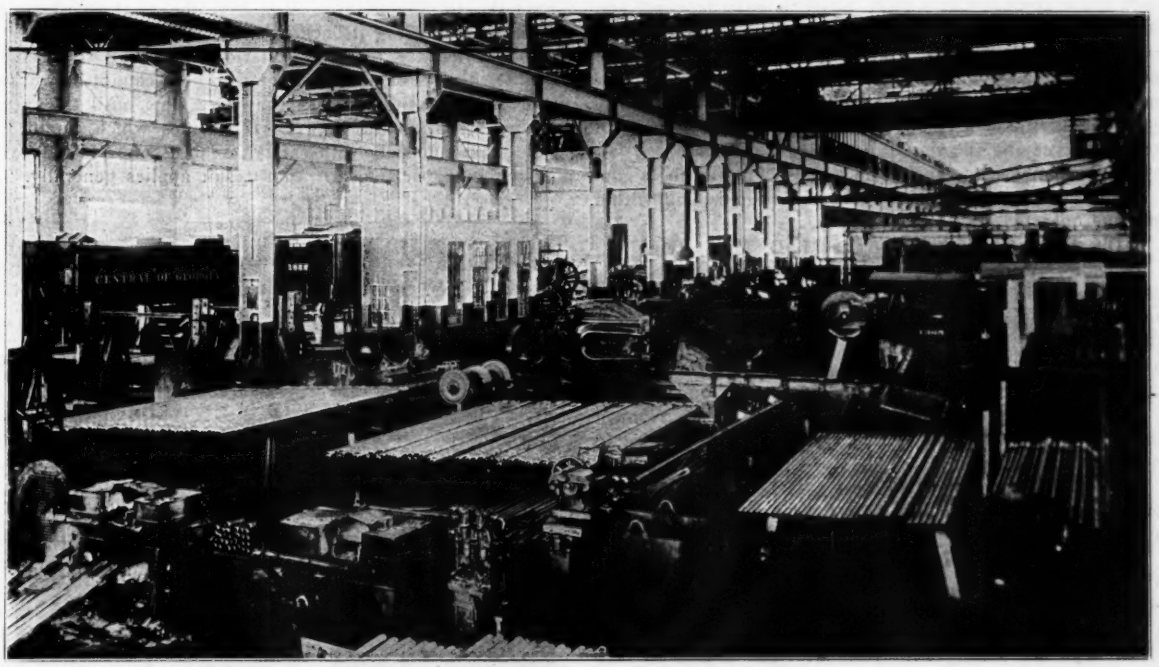
Throughout the shop the convenience and comfort of the employes have received careful attention. Numerous drinking fountains and urinals are conveniently installed, while clean

light lavatories and wash rooms are situated at suitable points. Janitors are constantly in attendance and every effort made to maintain the best possible sanitary conditions. Ventilated lockers for employes' clothing are suitably placed within easy reach of the machines and are sufficiently plentiful so that each man has his individual compartment. The floor is made of creosoted blocks which has proved very satisfactory. The general tool arrangement has been selected with a view to eliminating handling of the work as much as possible. This result has been obtained by grouping machines according to the classes of work rather than according to the kinds of machines. Thus each group of machines forms a complete unit and is constantly employed upon one kind of work.

The boiler and tank shop is 260 feet long and 130 feet wide, and is divided into two bays, one 60 feet wide used for erecting and the other 70 feet wide used for flanging, punching, shearing and other work of a similar nature. The boiler and tank shop is divided from the locomotive and machine shop by a fire wall with two main entrances, and through which the industrial railway enters, and the other through which the lower crane from the locomotive erecting floor enters. As previously stated this runway extends uninterrupted through both shops. Every facility has been provided for the rapid handling of work. In the end of the 60-foot bay nearest the erecting shop is located the equipment for making boiler repairs. The other end is used for flue work. In the end of the 70-foot bay nearest the machine shop, flanging, etc., is done, while at the other end tender and tank repairs are made. This shop is provided with riveters, hammers, shears, flanging and flue machines. The roof is saw-tooth construction, permitting excellent natural illumination at all times. This shop is amply provided with cranes, to facilitate handling of work.

Extending along the side of the blacksmith shop, the machine shop and the boiler and tank shop is a material platform served by a 15-ton gantry crane. Suitable magnets for handling scrap, plates and other material are provided. All heavy material used in the department mentioned is removed directly from cars onto this platform from which it is taken into the shops as needed. This platform is also used for sorting and storing scrap. The tire furnace is located on this platform opposite the large wheel lathes in the machine shop. At the end of this platform nearest to the flue department is located a flue rattler of the old cylindrical style, but arranged to be automatically filled after the flues are lifted into a cradle above the machine by the gantry crane. After being cleaned the flues are delivered to a somewhat similar cradle lower than the one mentioned from which they can be collected and removed by the crane.

The roundhouse is located some distance from the erecting and machine shop. This was partly necessary owing to the property lines. The outside walls are carried out to form a building of rectangular shape, the corners of which are utilized for the roundhouse machine shop. All the tools necessary for the work to be done are installed and no necessity has been found for carrying work to and from the main shop unless of extremely unusual character. The roundhouse is connected to the rest of the works by switch and industrial tracks and standard parts are carried in stock in the roundhouse store room.



Boiler and Tank Department.

An interesting feature of the roundhouse is an electrically operated drop table by means of which all the drivers or any of them may be dropped at one time. An electric mono-rail hoist is provided for carrying the wheels to the lathe in the machine shop for truing the journals. Two other tracks are provided for with wheel pits for handling single wheels and outside is located a pit for tender wheels.

J. B. Smith & Co., Knoxville, Tenn., has been awarded the contract for the construction of all structural and concrete work on the new double-track work of the Louisville & Nashville, between Ooltewah and Chattanooga, Tenn. The contract price was $100,000.

The Rangeley Lakes & Megantic, which was organized to build from Oquossoc, Me., north to the International boundary, will build the ten-mile section from Oquossoc to Kennebago. T. L. Dunn, chief engineer, Portland, Me.

The Louisville & Nashville will put up a new station, it is said, at Chapman, Ala.

The Signal Department

M. D. M. SIGNALING SYSTEM.*

In the M. D. M. system, an endeavor has been made to eliminate all complication. With this object, while realizing the idea of the route lever or key which is found desirable by the traffic department, the principle of individual levers is retained because this is the simplest, the clearest and the only system which lends itself to all combinations.

The characteristics of the M. D. M. system are as follows:

(1) Each point or signal is represented individually in the cabin.

(2) Operation at one movement and by means of a single key, of the points and signals of each route. All the sets of points are operated simultaneously and the route is made in the shortest possible time. The signalman is therefore free to devote his whole attention to watching the tracks.

(3) Route keys grouped in a "combiner" occupying but small space arranged in a table which is easy to read, and no training is required to understand it.

(4) Interlocking effected immediately on operation, and permitting of all combinations being made without preliminary study or arrangement.

(5) Positive and permanent indication of the position of the points, keeping the signal always in agreement.

(6) Permanence of the interlocking so long as the signal is not set to danger, or so long as the train is still within the zone operated.

Characteristic Features of the M. D. M. System.

Mechanical Route Combiner—The mechanical combiner is the appliance in the cabin which effects the characteristic methods of operating enumerated above. It is the combiner which selects from the individual details, corresponding to the various points and signals, those combinations necessary for making the route and securing the interlocking.

The combiner is of rectangular shape. On the front it carries the references which the signalman may require to use and also the knobs or handles of the route keys.

There is one key for each route. The same key is used for traffic in either direction. In their neutral position the keys stand at 45 degs.

To make a route, it is only necessary to perform the operation of turning its key to the vertical or to the horizontal position, according to the direction in which the route is to be used.

The keys are arranged in rows at right angles to each other, in which the horizontal rows refer to arrival tracks and the vertical rows to departure tracks or vice versa.

To make a route to connect an arrival track with a departure track, it is sufficient to look at the column and row referred to, and to turn the key which occupies their point of intersection.

To render the table more easy to read, the rows and columns are numbered. Each key is designated by the number of its row and of its column. Thus the key 43 is the key for that route which connects the arrival track represented by the row 4 with the departure track represented by the column 3.

Each row or column carries at its extremity an indicator signal showing the position of the signal giving access to the corresponding track. When a route is made the key is turned towards the indicator of the signal to be pulled.

The selection of the key and the direction in which it is to be moved are therefore capable of being grasped by anyone without special knowledge.

On the inside of the combiner, the points and signals are represented by metal planes parallel to the face of the board. There is one plane for each set of points (point plane), and one plane for each arrival or departure track, either with or without a signal (track or signal plane).

The keys are perpendicular to the front face of the board and run through the combiner from front to back, passing consequently through all the planes. When a key is required to control a plane it is fitted with a cam acting on that plane, otherwise it is without.

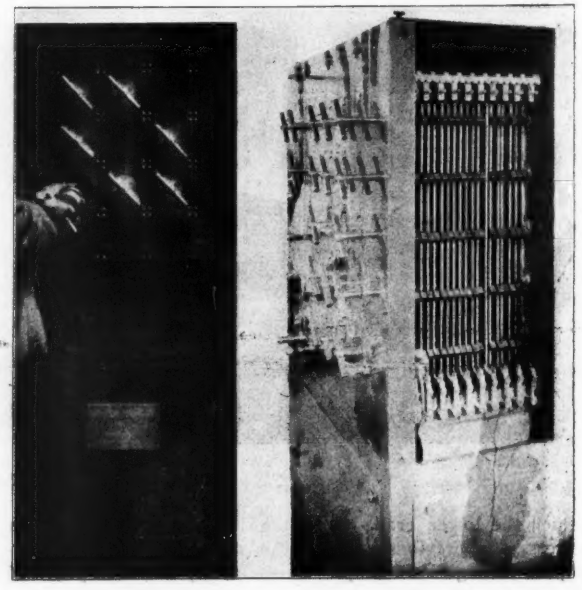
The cams are of two kinds, point cams and signal cams. They present the following features:

(1) When the key which carries them is in the neutral position the cams do not bear against the planes.

(2) When the key is turned they are displaced and then hold either to the right or to the left planes, of which the corresponding sets of points are to be moved to the right or to the left.

(3) Each plane so held, to the right for example, prevents the turning of any other key, the rotation of which would tend to bring it back to the left.

The routes are therefore interlocked among themselves, because the sets of points common to both cannot be worked from two opposite sides at the same time. All the interlocking arrangements between the routes which cannot be made simultaneously with safety, are thus effected naturally and without special gear. This result applies generally. It



Side View, Auto Combiner. Front View, Auto Combiner.

is independent of the plan and of the arrangement of the routes, whether the points are for simple crossings, double slip points, or cross-overs. It is obtained without scheming, since it depends on the one fact that any particular plane, that is to say, any one set of points, cannot occupy positions to the right and to the left at the same time.

The interlocking preventing traffic from running in opposite directions over the same route is even more simple: a single key cannot occupy both vertical and horizontal positions at the same time; hence it is not possible to make a route in two opposite directions at the same time.

It is this fact which explains the statement that in the M. D. M. system no scheming for the interlocking is required. It follows that with the mechanical combiner of the M. D. M. system any change can be effected immediately.

*From a Bulletin of the International Railway Congress.

By changing the number and position of the cams of a key, the plan of the route it controls can be modified as desired. By the addition of a key a new route can be made with any of those existing, and this can be done without troubling about the interlocking involved by the operations, irrespective of their number and arrangement.

Any kind of power supply can be used for the transmission to points and signals. In the applications already made, or being installed, hydraulic power is used (glycerine being added to the water in winter) in the case of transmission of force to a distance, and compressed air at low pressure is used as the motive power. The water acts the part of a connecting rod between the combiner and the motors.

This transmission of power by fluids is economical, free from risk of short-circuit, and has the advantage that its efficiency can be checked directly by the natural senses. In the M. .D. M. hydro-pneumatic cabins, the only power to be supplied is the compressed air. In the event of failure of the compressors a locomotive fitted with a compressed air brake can be brought up to the cabin and used temporarily.

Finally, if no locomotive is available, the motors at the points can be worked by hand, independently of the power supply.

Controllers.—By this term are understood those appliances which show that the point blades are home against the stock rail and also show the position they occupy in relation to that of the planes which represent them in the cabin.

The control of a route is effected by sending hydraulic pressure through a pipe to the departure end of the route and passing this to each set of points of the route in the opposite direction to that which will be taken by the train, that is to say, it is supplied first to the end of the route which the train will leave, and last to the end at which it enters.

When the pressure reaches the entering end, it returns thence to the cabin and operates the signal. Thus it is the pressure in the control pipe which throws over the signal.

In the cabin, the outward flow and return of the pressure in the control pipes is effected as follows: It has been shown above that each of the tracks entering and leaving is represented in the combiner by a plane. On returning the key corresponding to a route, the planes corresponding to its entering and leaving tracks are simultaneously moved. The displacement of the plane corresponding to the leaving track admits the pressure to the control pipes which are laid along the route which it follows. The displacement of the plane corresponding to the entering track admits the pressure in the control pipe to the entering signal of the route, when it has completed its travel along the track.

Between the leaving track and the entering track the pressure in the control pipes travels as follows: Each set of points is fitted with a controller, which is a sort of valve, open when the points are home in the direction to which they have been set by the combiner, and only for the period of operating, being closed in all other cases.

When the valve is open the pressure is admitted. When the valve is closed, on the other hand, it cannot pass and the signal at the entrance to the route remains at danger. The controllers represent the points and the intermediate pipes represent the tracks. The control is consequently an exact representation of the system of tracks.

It follows that the control pressure on being admitted to the controllers of a set of points is transmitted thence to the next and thence to the next, and so on, thus completing the route. If a set of points does not occupy the desired position, it stops the transmission of the pressure and the signal will not operate. If at any time and from any cause whatever anything goes wrong, the pressure ceases to be transmitted and the signal returns to danger.

To sum up: in order that the entering signal of a route may occupy the line-clear position it is necessary that: (1) The key corresponding to this route should be turned in the proper direction; (2) That the points along this route should each be thrown over fully and that the point tongues should be home against the stock-rails. The control is therefore positive and permanent.

There are some joints worthy of notice in this method of controlling: (1) If the pressure in the control pipe finds a continuous passage enabling it to connect the leaving and entering ends of the route, then the tracks also give a continuous route ready for the train to enter. (2) From the fact that a set of points cannot simultaneously be set to the right and to the left, a natural form of interlocking is afforded on the tracks, obtained from the position occupied by the points, of a similar character to that given by the planes in the combiner, which correspond to the respective points and in fact it is a kind of duplication of this; this amounts to the same thing as stating that it is just as impossible to obtain simultaneously from one set of points (1) on the track the control of routes which would form an unsafe combination as it is impossible to transmit from the combiner in the cabin controls which in combination would be unsafe.

This property of the system, taken in conjunction with the individual character of the operating gears, enables the most complex routes for connecting entering and leaving tracks to be made at once, even without the route keys. This is a valuable advantage in cases of alteration to the tracks or of sudden change in the method of working.

The control is sometimes supplemented by an electrically-operated indicator board in the cabin, which shows the tracks and the position of the points. This apparatus is merely an indicator. It has no action on the position occupied by the points or signals.

Signal controllers.—It is important that the return of the route key to its normal position, and the consequent release of the interlocking arrangements, should not be possible before the signal controlled by that key has been actually set to danger. The signal controller effects this in the following manner: Every signal when at line clear practically locks the track plane which set it to line clear.

The key, which was turned to cause the clearing of the route, is capable of being turned through an angle sufficiently large to ensure the return of the signal to danger. It cannot, however, complete its rotational movement until the track plane has been freed, that is to say until after the signal has completely and actually returned to danger.

The movement of returning a route key to its normal position when this controls its signal must necessarily be performed in two steps: first step, partial rotation of the key, signal returns to danger; second step: completion of the rotation of the key, freeing of the interlocking arrangements.

Transit. Block system.—The transit is a form of interlocking which prevents the route key from being returned to normal from the moment the train has entered the section operated from the cabin, until the last pair of wheels has cleared the section.

To ensure this, the train itself locks the plane of the combiner corresponding to the leaving track so soon as it enters the route and it only releases it when it leaves the route.

The connection between the entering and leaving tracks is fixed by the combiner, by the position occupied by the key itself, that is to say at the intersection of the row which corresponds to the entering track with the column which corresponds to the leaving track.

To the transit is sometimes added the block system. In this case, the signal towers adjoin the rows and columns of the combiner. The keys when turned couple them in pairs. Usually this connection is all that is required, but in some cases the setting of a signal arm to line clear causes a key connecting two cabins to be locked.

Backing down.—The routes over which backing down operations are effected are generally incomplete. They are however true routes, and, for this reason they are provided for in the general scheme of the M. D. M. system. Under these circumstances the solution of the problem presented by backing down, does not require any special consideration apart from those already set forth.

M. D. M. auxiliary controller.—In the first application made of points-controllers of the M. D. M. system in 1907 at the Cabin A at Landy, some of these were connected to the points by rigid rodding of considerable length. The regularity with which they operated, under special conditions, led to the idea of using them "to ease the heavy pulls" in cabins fitted with Saxby apparatus.

The connection is made in the following manner: The points-controller is placed at the base of the cabin and is connected rigidly to the rodding. An M. D. M. transmitter is fitted adjacent to the Saxby lever, to which it is coupled by a strap-ended connecting rod. Two fluid connecting rods are employed between the transmitter and the controller, the one for bringing to normal position and the other for throwing over.

The mode of operating is as follows: When the lever in the cabin stands in its normal position, the points and the controller which are rigidly connected to it by the rodding, are normal also.

If the lever is moved from the normal position, the controller comes into action at once and assists the operations until the lever is thrown completely over and the points are also thrown over. In the converse movement, the controller acts in restoring the points and the lever to the normal position.

By varying the air pressure admitted to the M. D. M. auxiliary controller the force exerted by it can be increased or diminished. The M. D. M. auxiliary controller can therefore, at will, only give assistance to the signalman, or on the other hand, can of itself perform the operation as rapidly as may be desired.

Should the pressure fail, the signalman can move the Saxby lever just as though no auxiliary controller were fitted.

The Maintenance of Way Department

STANDARD PRACTICE CARDS, ERIE R. R.

The Erie R. R. has gotten out a set of "Standard Practice" cards for the Maintenance of Way department. The object of these cards is to give instruction and information concerning track work, in a compact form. The instructions are short and to the point, but are complete. The points covered are gang organization, methods, standard construction, etc., as follows:

Elevation and Gage of Track.

Degree of Curve	Table for Elevation of Outer Rail. Speed in Miles Per Hour. 30-Miles inches	40-Miles inches	50-Miles inches	60-Miles inches	Track shall be gauged to Ft.	In.	Gauge allowed account of Rail-wear Ft	In
1	1	1¼	1½	2½	4	8½	4	9
2	1½	2¼	3	4½	4	8½	4	9
3	1¾	3¼	4½	6	4	8½	4	9
4	2¼	4¼	6	6	4	8¾	4	9¼
5	3	5¼	6	...	4	8¾	4	9¼
6	3½	6	6	...	4	8¾	4	9¼
7	4⅛	6	...	...	4	8¾	4	9¼
8	4¾	6	...	...	4	8⅞	4	9⅜
9	5¼	6	...	...	4	8⅞	4	9⅜
10	6	6	...	...	4	9	4	9½
11	6	...	...	...	4	9	4	9½
12	6	...	...	...	4	9	4	9½
13	...	...	...	...	4	9	4	9½
14	...	...	...	...	4	9	4	9½
15	...	...	...	...	4	9	4	9½

Maximum elevation should not exceed 6 inches.

When occasioned by the wear of the rail head, gauge will be allowed to widen to that shown in column headed, "Gauge Allowed on Account of Rail Wear." When occasioned by any other cause, it must be corrected promptly. No variation greater than the above will be allowed in any track curve.

No side track shall have an elevation of more than one inch, excepting engine running tracks, for which special instructions will be issued.

The column for gauge also applies to turnouts on switches.

The elevation at the beginning of a curve should be as great as at any other part of it, except at reverse points and where short tangents occur between curves of opposite directions. To insure smooth running, especially for trains at fast speed, the elevation must commence on the tangent and increase regularly until the curve is reached. The following table shows how far from beginning of curve the elevation should commence:

For 1 in. elevation, 50 ft. back on the tangent,
For 2 in. elevation, 100 ft. back on the tangent,
For 3 in. elevation, 150 ft. back on the tangent,
For 4 in. elevation, 200 ft. back on the tangent,
For 5 in. elevation, 250 ft. back on the tangent,
For 6 in. elevation, 300 ft. back on the tangent,

increasing thus 50 ft. for each in. of elevation.

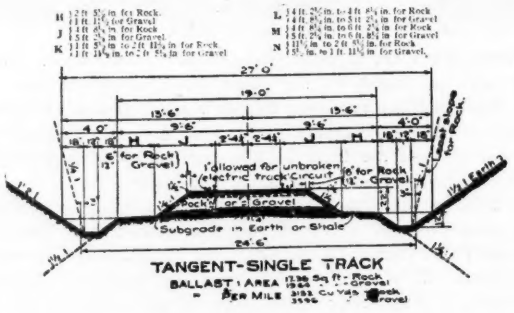
In reverse curves, rails must be level with each other at the reversing points; from the reversing point the elevation must be carried in either direction at the rate of 1 in. in 50 ft. Where short tangents of insufficient length to apply the foregoing table intervene between curves of opposite direction, the middle of the tangent shall be the neutral point at which the elevation in either direction shall begin. These rules apply to all regular curves. On curves with spiral ends, the elevation shall conform to the spiral.

Ballast.

New Ballast.—New ballast should not be applied until the sub-grade has been prepared to conform with standard section per standard practice card No. 2.

Tracks should be raised to stakes set by engineer.

Stone Ballast, (Method)—Pick tamp all ties on both sides from the ends to a point twelve (12) in. inside the rail. Center of ties to be lightly filled by use of ballast fork. Allow sufficient time (minimum, one week) to elapse for ties to secure a good bearing, then resurface the tracks with



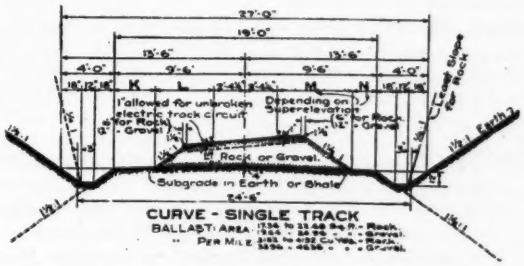
a light raise. When resurfacing, joint ties should be tamped hard at the joint end, easing off on the quarter.

When track has been put to a true line, fill and trim to standard section as shown. Ballast should be neatly lined on the outsides by using a straight edge six (6) in. wide.

All surplus ballast should be piled and promptly removed

after second raising and resurfacing. Use ballast forks for handling stone ballast.

In gravel, granulated slag and cinder ballast, tamping picks should be used only on joint ties, using shovels on all others.



Stone Ballast—Force.

Foreman	1	
Assistant Foreman	1	sighting track.
Assistant Foreman	1	track tampers.
Laborers	1	digging jack holes.
Laborers	2	holding ties tight to rail.
Laborers	2	driving spikes home.
Laborers	4	operating jacks.
Laborers	4	tamping at jacks.
Laborers	16	tampers.
Laborers	4	partially filling and dressing track.
	1	water carrier.
Total	37	

Foremen applying ballast or surfacing track shall observe closely its action under passing trains and shall immediately, after the passage of train, sight the track, and should it show such movement as would indicate ineffective tamping, they will raise the track to proper surface and have it thoroughly tamped before leaving same.

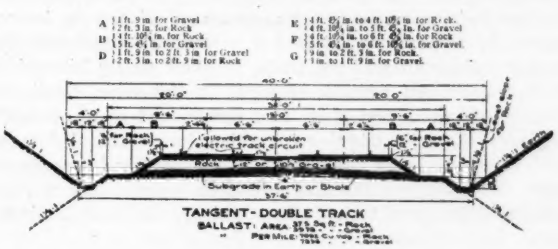
Laying Rail.

LOCATION.—Location is determined upon at the end of the calendar year. During the winter when track work is impracticable, the adzing, as far as possible, should be done. Whenever possible the supervisor should be present when the rail is relaid.

Force required for laying single rail:

Foreman	1	Spike pullers	4
Assistant Foreman	2	Spikers	4
Flagmen	2	Adzers	5
Tong men	8	Shim men	2
Applying joints	8	Tools and supplies	1
Water carrier	1	Rail removers	2
Total force			40

When two rails are laid, the above force, excepting the flagmen, should be duplicated. When two lines of rail are relaid the second rail should not be laid until the first rail is in place and spiked. On straight track it is permissible to couple rails together before sliding into exact position. On curves, rails should be laid one at a time. Idle time should be used in removing angle bars from old rail.



The flagmen furnish protection in each direction. The spike-pullers pull all spikes to permit old rails to be removed.

Note: When the proper gauge can be maintained draw spikes on the outside of the rail. When rail wear or change in design of rail affects the gauge, pull spikes on the outside of one rail and the inside of the other, and where necessary, pull the two outside lines and one inside line of spikes. The proper gauge is to be made as the new rail is laid. In no case shall rail be laid to a closer gauge than authorized as standard.

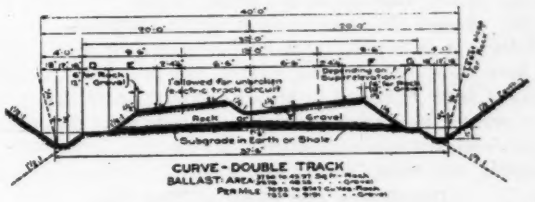
The rail removers carry lining bars to throw out old rail. The adzers do all necessary adzing. The tong men place the new rail into position. One shim man removes and clears the rail seat, and one places and adjusts shims by use of thermometer.

When continuous joints are used, two additional men should be used to help apply them. The spikers spike the new rail in position and carry a gauge to correct bad spots immediately. The tool man collects with a light push car, all tools, spikes, bolts, nuts, nut-locks and any small material left on track.

Loading and Unloading Rail.

Before old rails are loaded they must be inspected and classified by the supervisor, by use of a caliper. Three classes to be used, as follows:

First.—All rails suitable for main track relaying, marked with one stripe of white paint across head of rail.



Second.—All rails suitable for side track relaying marked with two stripes of white paint across head of rail.

Third.—All other rails, marked with three stripes of white paint across head of rail.

Force Required for Operating Rail Loading Machine.

Loading:

One man to operate machinery,

Two men on car.

Two men, one on each side of car, handling guy ropes.

One additional man required on high side when loading against a curve.

Preliminary work of marking center of rails is to be done in advance.

Unloading:

One man to operate machinery.

Three men on car, one for marking center of rail.

Two men, one on each side of car, holding guy ropes.

One additional man required on high side of curve when unloading against curve.

The above applies to all new and relaying rail. Scrap, short lengths, is to be loaded by hand.

Program of Season's Work by Regular Section Forces.

Section Force.—One foreman. The number of men to be designated by the superintendent and approved by the engineer maintenance of way. Under normal conditions the following routine will prevail and in the order named:

(1) Drain the road-bed by removing all obstructions in ditches and culverts in order to allow water to run off freely.

(2) Clean up yards, tracks, station grounds and right of way.

(3) As the frost leaves the ground remove all shims and take them to tool-house.

(4) Go over entire section and do the preliminary surfacing, tamp loose ties, drive home all spikes and tighten all bolts.

(5) Make tie renewals and switch timber renewals in main track, beginning at end of section farthest removed from, and working toward tool-house. It is required that all ties be fully spiked, tamped, and ballast replaced the same day they are applied. In putting in new ties the use of picks or sharp pointed instruments is forbidden. During the renewal all condemned ties removed from the track should be piled for burning as removed, and burned each week, if conditions permit.

(6) After new ties are placed in the track, sufficient time (minimum one week) should elapse to permit the new ties to secure a good bearing, when the track should be gone over and given a finishing-surface, using the level in all cases, and the track should be lined and gauged and the ballast trimmed at the same time to conform to the standard section; clean ballast of all vegetation.

Note: When the rail or ballast program provides for rail renewal, new ties should not, under normal conditions, be applied until after new rail or ballast is laid.

(7) It is required that the right of way be mowed at the time designated by the engineer of maintenance of way, to prevent noxious weeds going to seed. The order of this item may be changed if necessary.

(8) Do the necessary ditching and repairing of embankments.

(9) Renew the necessary switch timbers and ties in side tracks, cutting them off at the proper length.

(10) Reduce the force to meet winter conditions.

Note: It is required that care be exercised at all times to keep all switches fitting tightly, switch stands properly secured, frogs tight and in proper position, guard rails properly secured in correct position and track to proper gauge, cross level and super-elevation. All emergencies should be properly met regardless of the order of routine.

Distributing and Piling of New Ties.

Ties will be received for the following year's renewals after the working season is closed. They should be held on hand in cars until a sufficient number are received to justify the use of an engine to unload. Then distribute and place as near to point of using as possible, unloading from 40 to 50 ties to the pile.

Ties should be piled pyramid or "A" shape not higher than 6 ft., lightly covering pile with cinders or earth and removing all dead grass and weeds from around them. Piles of ties are to be not less than 50 ft. apart.

In carrying ties to piles men are to work in sets of three, two walking ahead with wooden bar under tie and one at rear. In unloading ties from cars men are to work in sets of three and not to exceed nine men on car. In loading ties men are to work in sets of five, three men carrying to car and two on car. The number of men carrying ties should not exceed three at any time.

Tie Inspection and Renewals.

INSPECTION.—The selection of ties to be removed from track for renewal on each division should be made by one or more track tie inspectors, as soon after March 1 of each year as weather conditions will permit, prior to July 1, and the report should be sent direct to the division engineer.

Each tie to be removed must be carefully examined, the local conditions being carefully studied and taken into consideration; the condition of ties on each side, and the amount and character of traffic, the location of the ties, whether on a tangent, curved track or under a joint, etc., must be carefully considered. A much more rigid inspection is possible on straight track with light traffic, than where traffic is heavy and on a sharp curve.

When the inspection is made the section foreman on each section shall be present and assist in the work. A third man will be necessary to do the spotting and carry the work along rapidly. The inspection should begin at the lowest mile post and work toward the greater.

MARKING.—Ties to be removed should be designated by marking the web of the rail directly over the tie, with a spot of white lead paint. Where it is expected the rail will be removed prior to the change of ties, in addition to the spot on the rail the tie should be spotted near its end.

LOCATION.—As the tie inspection is made the total number of ties in each mile will be counted and shown, the number to be renewed in each quarter of a mile will be shown, and also the number of unapplied ties. Where there is no mile post, telegraph poles will be used to designate the location. When the inspector has finished one section, he will forward one copy of his inspection report to the division engineer, one to the supervisor, one to the engineer of maintenance of way, and leave one with the section foreman. The supervisor will then be enabled to distribute the ties needed for each mile or quarter of mile.

RENEWALS.—When the section foreman has completely finished the renewal of ties on any one mile, he will forward a statement to the supervisor, showing the exact number of ties that he changed on the section, whether it agrees with the inspection report or not. If the statement does not agree with the inspection report, an explanation must accompany the foreman's statement.

The supervisor will then forward to the division engineer and the engineer of maintenance of way a report showing the number of miles completely finished on his sub-division, on the 10th, 20th and end of each month. No ties should be reported in a mile unless all the ties to be changed have been put in. No ties shall be removed from the track except broken ties or ties marked for renewals (except in cases of emergency), without the express permission of the division engineer.

SWITCH TIES.—Switch ties which have become unserviceable from decay or other causes will be renewed. These will be measured and the number and length of each to be renewed will be recorded and the rail painted by the inspector, as for cross ties. The track and switch should be named and this information given the division engineer to enable the proper distribution of switch ties. The distribution is to be made from the cars, which should be loaded in station order and lengths for this purpose.

SIDINGS.—It is desirable as far as possible, that the instructions above be applied also to renewal of ties in sidings. The record of ties should be kept with the name of the siding instead of the quarter mile, the painting or marking to be done in the same way. Chestnut and cedar ties may be used on tangents of standing or back off track. A separate list covering such tracks should be kept in such cases.

Note: It should be distinctly understood by the track supervisor that the above standard practice does not in any way relieve him of his responsibility for the proper maintenance of the track under his charge. If, on being furnished by the division engineer with statement of ties to be removed he is not satisfied that this number is sufficient for proper maintenance of the track, he shall satisfy himself as to the additional number required in the same detail the former inspection was made, and recommend to the division engineer that the additional number be furnished him at each point where his judgment has indicated as being necessary. The division engineer will then assume the responsibility of failing to furnish the additional ties if, in his judgment, they are not needed.

Application of Tie Plates.

It is required that the ties be first scored, scribed or cut crosswise with the adz, both outside and inside the rail, and as far back from the rail as the adzing is to extend to suit the plate to be used, cutting the ties as deep as the adzing is likely to be required. Pull both inner and outer spikes of rail only for a distance sufficient to admit of rail being sprung or moved toward center of track, clear of its bed, to give room for the proper adzing of the ties.

It is required that all spike holes be plugged, then adz the ties level the entire width to a uniform surface, to extend not less than ½ in. beyond the ends of plates. To insure a true and even surface, and prevent it being concave or hollowed out, the adz should work diagonally and across the tie. The adzing for low rail of curves should be done so as to cant the rail inward, not less than 1-8 in.

After adzing, tie plates should be placed on the beds prepared for them and the rail moved back to its position on top of the plates.

No plates should be imbedded until at least every second plate on curves and every third plate on tangents have been spiked to place, using the gauge on opposite rail, yet undisturbed, to bring the track to gauge. In spiking plates, spikes should be driven plumb, care being taken to bring the shoulder of plate snugly up to base of rail for its entire length. When plates are applied on curves, the plates should be driven a little so as to give them a hold on the tie and thus aid the spikes holding the rails to place until they are fully imbedded and spikes driven home.

In driving the plates down, it is required that both ends of plate be struck at the same time. When driving plates down on the low rail of curves, the inner end of the plate should be driven further down than the outer end, as the superelevation of the curves throws the greater weight toward the outer base of the rail, thus settling that end of the plate quicker than the end on the inside of the track. One rail of the track being thus equipped with plates the work may now be repeated on the opposite rail, thus having always one rail to gauge from.

Switch Heating Equipment.

INSTALLATION.—(1) It is required that the installation consist of 1" pipe; two pipes being joined to each other by means of a return bend, and to extend over full length of ties, thus making a unit.

(2) One unit to be placed in each space between ties and to be coupled together by means of 1" unions; using four to six units per switch under the section where the point strikes against the stock rail.

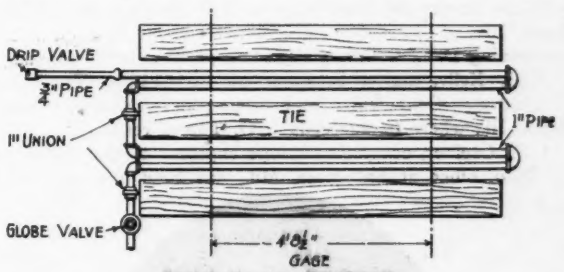
(3) The size of the lead pipes to be as follows: 1" for one to three installations; 1½" for four to eight switch installations in series; 2" for nine to fifteen switch installations in series. In no case should more than fifteen installations be connected in series.

(4) Each switch installation is to have a separate ¾" Jenkins diamond steam trap, and the pipe to be laid so that the drip is at the lowest point.

(5) Each switch installation is to have a 1" Globe valve, and each lead is to have a Globe valve of the same size as lead used.

(6) The steam pressure is to be not less than 10-pound gauge at any point from which a lead is taken from main steam line.

OPERATION.—(7) At starting, the steam valve is to be slowly opened wide and each installation regulated by means of the diamond steam trap so that only hot water escapes.



Switch Heating Equipment.

(8) When shutting off, each switch installation must be blown out and uncoupled to prevent freezing.

Stringers in Wooden Spans.

Where bents are used, stringers must break joints over them. In coal trestles, where stringers are used without ties, two (2) stringers, 8"x16" should be used with not more than nine (9) ft. between bearings; that is, ten (10) ft. center to center of bents. The rail should then rest on blocks four (4) in. thick, extending across the two (2) stringers.

The distances shown in the table below are between bearings and not center to center of bents. The number of stringers specified is per rail, and cross ties are to be used in each instance.

Standard Stringers for Different Spans.

Clear Span Between Bearings	Number and size of pieces under each rail.	Material.
Up to 7'-0"	Two 8"x16"	Long Leaf Yellow Pine or White Oak.
	Two 12"x12"	" " " " " " "
7'-0" to 9'-0"	Two 8"x16"	" " " " " " "
9'-0" to 11'	Three 8"x16"	" " " " " " "
11'-0" to 13'	Four 8"x16"	" " " " " " "
13'-0" to 14'-0"	Four 8"x16"	" " " " " " "
14'-0" to 15'-0"	Three 8"x18"	" " " " " " "
15'-0" to 16'-0"	Three 10"x18"	" " " " " " "

Note: Wooden spans over 13'-0" to be used in case of emergency only.

R. H. Van Santa and Shirley Houghton, San Francisco, have been awarded the contract for constructing a 15-stall roundhouse at Riverbank, near Modesta, for the A., T. & S. F. Work has been started and the contract calls for its completion by April 30. Provision is to be made for 10 extra stalls.

Engineers of the Elgin, Joliet & Eastern have completed surveys for the proposed improvements at Rossville, Ill., including the construction of a new roundhouse to accommodate 18 engines.

The Grade Crossing Commission, Buffalo, N. Y., recently held a hearing on the question as to whether the crossing at grade at Austin, Amherst and Tonawanda streets over the Erie and Lackawanna tracks should be eliminated by subways or viaducts.

It is reported that the Missouri, Oklahoma & Gulf has contracted for the construction of four bridges along the proposed line between Wagoner and Joplin. The structures will be of steel and will span the Grand and Spring rivers.

Personals

W. H. Harland, Jr., signal engineer has been appointed electrical and signal engineer of the New York, Ontario & Western, in charge of the maintenance of all electrical equipment and signals.

W. S. Hanley has been appointed division engineer of the New Orleans Great Northern, with office at Bogalusa, La., succeeding D. L. Cullan, resigned to go to another company.

J. G. Kelly, master carpenter of the Chicago, Burlington & Quincy at Centerville, Ia., has been transferred to Beardstown, Ill., where he succeeds J. O. Thorn, resigned

J. E. Greiner, consulting bridge engineer of the Baltimore & Ohio, office at Baltimore, Md., has been also appointed

J. E. GREINER,
Consl. Bridge Engr., B. & O. R. R.,

consulting engineer of the Chicago Elevated Rys., to design a city and railway bridge over the Chicago river.

W. F. Hart has been appointed chief engineer of the Memphis & Gulf, succeeding A. M. Van Auken, resigned. The office is at Nashville, Ark.

John C. Kuhns has been appointed purchasing agent of the Illinois Central, office at Chicago, succeeding C. F. Parker, elected vice-president.

A. C. Mann, chief clerk in the purchasing department of the Illinois Central, has been appointed assistant purchasing agent to succeed John C. Kuhns, appointed purchasing agent. The office is at Chicago.

W. N. SPANGLER,
Insp. of Sigs., Pennsylvania R. R.

The office of John D. Isaacs, consulting engineer of the Union and Southern Pacific, has been moved to New York.

B. F. Oler, supervisor of signals of the Pennsylvania, at Camden, N. J., has been appointed supervisor of signals at New York, succeeding W. N. Spargler who has been appointed inspector of signals with headquarters in the office of the signal engineer of Philadelphia, Pa. E. K. Post, supervisor of signals at Media, Pa., has been transferred to Camden, N. J., to succeed B. F. Oler. W. I. Bell, assistant supervisor of signals, Altoona, Pa., succeeds E. K. Post. P. A. Rainey, assistant supervisor of signals at Harrisburg, Pa., succeeds W. I. Bell on the middle division, with office at Altoona. E. G. Bauman, signal foreman at the Jersey City terminal, succeeds P. A. Rainey at Harrisburg, Pa. L. E. Carpenter, supervisor of signals at Williamsport, Pa., has been appointed supervisor of signals on the Philadelphia terminal division, office at West Philadelphia, to succeed C. E. Goings, transferred to the office of the signal engineer. J. H. Broadbent, supervisor of signals on the Allegheny division at Kittanning, Pa., succeeds L. E. Carpenter at Williamsport, Pa. B. F. Dickinson, assistant supervisor of signals at Jersey City, succeeds J. H. Broadbent at Kittanning, Pa. E. M. Hatton, acting assistant supervisor of signals on the Baltimore division, has been appointed assistant supervisor of signals on the New York division, succeeding B. F. Dickinson.

C. H. Kenzel, assistant purchasing agent of the Elgin, Joliet & Eastern has been promoted to purchasing agent and his former position abolished. The office remains at Chicago.

J. H. Guess, assistant general purchasing agent of the Grand Trunk has been appointed general purchasing agent to succeed A. Butze, retired under pension. R. Johnson succeeds J. H. Guess, the office of both being at Montreal, Que.

THE WOP.

When the line is surveyed through the scenery
For tunnel and culvert and cut—
When the contractor has his machinery
The "big job" is ready—all but——
"All but" means the shovel and pick of it—
The hunkies who work till they drop.
And so, in the dust and the thick of it,
Look for the Wop!

The big bosses bear all the fret of it—
They are the fellows who plan;
But the backbreaking strain and the sweat of it
Fall to the laboring man—
Dago and Russ and Hungarian—
All of the immigrant crop.
Where is the job we could carry on—
Save for the Wop?

Subject for scorn and bedeviling;
Victim of fraud and chicane—
Still, with his spade, he is leveling
Routes over mountain and plain.
Progress? His soul is the breath of it;
Lacking his hand, it would stop.
Facing the danger and death of it,
Here is the Wop!

He knows the hardest and worst of it;
He knows the hard-driven toil,
The ache and the heat and the thirst of it—
Never the dream—or the spoil.
Caves and explosions make mud of him—
Who cares a damn? Let him flop!
Progress is stained with the blood of him—
Only a Wop!

—Berton Braley.

USE AND ABUSE OF INSPECTION.

It has been remarked that society in these days is rapidly becoming divided into two classes—the inspectors and the inspected. Engineers especially realize that there is a great amount of truth in this saying, as few orders are placed nowadays for engineering plant or materials which do not stipulate for inspection. This tends to become stricter every year, owing to various reasons, the chief being that manufacturers, in selling their goods are now generally bound down both in price and time of delivery, the former being so low and the latter so short that mistakes are more liable to occur than was the case in the old days, when the manufacturer could ask and obtain his own price and could take his own time. In those days the buyer often had to take what the manufacturer gave him, and was glad to get it at almost any price. But now the buyer knows quite well in most cases what he wants, what price he ought to give, and exactly what he ought to get for that price, and his main object is to see that he gets it. It follows therefore, that buyers have come to the conclusion that their interests will be best served by employing inspectors empowered to visit the works of the contractors at all reasonable times, without notice, and to follow the course of the order through the works, testing the materials and the finished work, and checking quantities, weights, etc.

The knowledge that the inspector may visit them at any time has a good effect upon contractors in keeping them up to the mark, both in quality and time. This effect is an all-round one and to other than inspected work, as manufacturers know very well that when they are constantly having inspectors in the works it is not desirable to have too much second-rate work lying about. Inspectors do not judge a works entirely by the quality they get themselves, and their opinion carries considerable weight. The very fact, therefore, that a number of buyers send inspectors to any one works makes that works a more reliable place for other buyers, who do not employ inspectors, as the frequent presence of inspectors has a good effect on the general quality of the work turned out of any manufactory.

There is, of course, no attempt on the part of firms of good standing deliberately to defraud their customers. But at the same time manufacturers cannot afford to do more than keep to the bare specification, and specifications are often interpreted differently by buyers and sellers. Then, again, the heads of a firm cannot always attend to every detail, and foremen and workmen will often scrimp work, either because they are on piecework, or merely to save themselves trouble. In the matter of loose rivets in steel-work, blowholes in cast-iron pipes, and such-like, small but important defects, the inspector cannot lay the blame on the manager or foreman unless the flaws are numerous. But it is his business to find these flaws out, and if he discovers a number and sees them put right in the early stages of an order, he will find that the workmen will take more care afterwards. Again, mistakes are frequently made in dimensions, and many firms have no systems of checking their finished products, even when the matter is left in their hands.

A good inspector, dealing with large quantities of materials, will save his employers many times his salary in the course of a year. But, to gain the full benefits of inspection, a good man must be engaged. An inspector cannot be an expert in everything, but he must have a very clear idea of the difference between good and bad work, and must be able to read drawings easily. Then an inspector must be firm and able to hold his own, but at the same time tactful, and his honesty must be above suspicion.

An inspector with the above qualifications, and who is also the equal socially of the managers of the works he visits, can do a great deal for the firm which employs him. At the commencement of a contract he goes through the specification and drawings and clears up any doubtful points, both with his own firm and the contractors. He also informs the contractor what kind of work he expects to get and what processes are to be employed on the various details; for instance, it is often left to the inspector to say whether holes are to be drilled or punched; whether plates are to be sheared or planed, rods and bolts solid or welded, etc. When the work commences the inspector will test the materials and see that no unavoidable delay takes place at rolling mills, and will then follow the work through the contractor's shops and see that the various processes are carried out as specified, or as he wishes, and that the finished work comes together correctly, is of the proper dimensions, and, if necessary, is properly marked for re-erection. Besides these duties the inspector is often required to verify weights, and to attend to packing and shipping marks, and occasionally to see the goods actually put on board.

If he is a tactful man and knows his business, he can get the contractor's manager and foremen to agree to his suggestions and requirements with very little trouble, and to push his work on as quickly as possible, and in the case of any alteration he acts as a buffer between the buyers and the contractors. An inspector of this kind is worth a good salary, and if employers have not sufficient work to keep a highly-paid man of thir own busy, it is better for them to employ an outside independent inspector than to keep a poorly-paid man, or to send out draughtsmen or others on inspection work, as it takes a regular inspector several years to find out the little tricks by which foremen and workmen sometimes try to deceive him.

There are, however, a number of independent inspecting engineers who will offer to take inspection work at extremely low and insufficient rates. They can only do this by employing very young and badly-paid men to do their work for them, or else by giving half the time to it that they should. It may be taken as an axiom that in the majority of cases cheap inspection is worse than no inspection at all, as it relieves the contractor from liability without giving the buyer a sufficient guarantee that the work is properly carried out. There is, of course, certain work which can be attended to by an inexperienced inspector just as well as by an experienced one, but, as a general rule, when work which has been cheaply inspected turns out satisfactorily, it would have been just as satisfactory if it had not been inspected at all.

This brings us to the question of the abuse of inspection, about which manufacturers have a great deal to say, although it affects the buyers more than they are perhaps aware. An inspector may be very conscientious, but either through want of tact or experience, or both, he may be the cause of endless trouble between buyer and seller. Such a man walks into a works as though it belonged to him, calls the manager and foreman over the coals for the slightest cause, treats them openly as though he believes they are deliberately trying to cheat him, persists in sticking to the exact letter of the specification, and rejects quantities of material for little faults which do not matter in the least. The result of all this is that he is disliked wherever he goes, his work is delayed, and people who would not do it otherwise try to get the better of him in order to get him into trouble. Besides this, contractors who have had experience of an inspector of this kind makes allowance for him in their next quotation and ask higher prices.

Unnecessarily strict and minute inspection is not, however, always due to the inspector, as his employers may tie him down to the specification, and practically refuse to allow him to use his judgment at all. Certain consulting engineers are very strict in this way, and are so well known that extra prices are always charged to cover their inspection.

Another abuse of the inspection system is to send an inspector to see very small quantities of material; we have known many cases in which inspectors have traveled long distances to inspect, perhaps, 1 cwt. of ordinary quality steel, the cost of the inspection coming to two, three, or four times the cost of the material. Considerable delay is often caused, also, by hav-

ing these small orders inspected, as the inspector may have to wait days before he can visit the works, owing to pressure of more important work, and favorable opportunities of forwarding the material along with other goods are thus missed. Moreover, if the material has to be tested, the inspector may have to pay two visits to the mills, one to select and stamp the test-pieces and another to see them broken, as the mills cannot always prepare the test-bars the same day.

To sum up the whole question: inspection is useful and worth while under certain conditions, but not under all conditions. It pays well to inspect, provided the inspector is a firm and tactful man with a good general knowledge of engineering and inspection, and with an honest and honorable character, and provided also that he has plenty of work on big orders and is given a fairly free hand and allowed to use his judgment in the interpretation of a specification. In other words, the inspector must be a good one and must have plenty to do, and the more costly the work that he inspects the more worth while the inspection.

Inspection, as a general rule, does not pay when the reverse of these conditions is the case: when the inspector is tactless, of weak character, without experience, or badly paid. It does not pay to be very strict on small variations from the drawing or specification which do not affect the quality of the work, nor to send an inspector to pass every small order, unless for special material. It is also a question whether it pays to inspect cheap materials, such as bricks, tiles, earthenware pipes, paving, etc. These things are bought in large quantities, and the inspector usually sees them stacked in the maker's yard. It is impossible for him to examine more than a small proportion unless he sees the whole order loaded up, which might oblige him to be at the works for several days, and would add considerably to the cost of the articles. He cannot very well mark each item unless he sees them loaded up, in which case there is no need to mark, and the result is he passes them in bulk, which leaves the manufacturer free to load up all the defective items not seen by the inspector. In the case of materials of this nature it is certainly the best way to buy on sample, without inspection, and return defective goods.

Whether a firm should employ their own inspector or not depends on whether or not they can keep him busy all the time. If they only require to have goods inspected occasionally, it is better to employ a regular outside inspector than to send out one of their own staff, unless he is fully qualified for the particular work. A firm has a better hold in some ways on its own inspector, but as the outside inspector's living also depends on the satisfactory nature of his work, he is not likely to neglect it, and a well-established outside man has a wider experience of inspection than a man who only works for one firm, and experience counts for a great deal in inspection. The more works a man visits, and the greater variety of materials he inspects, the quicker he will be to detect bad work, to suggest improvements, and to get orders through satisfactorily.—*Engineering.*

TEREDOS KILLED BY ELECTROLYSIS.

A very successful demonstration was recently given in Seattle, by the Marine Wood Preservation Co., of Seattle, of their method of destroying teredos and other marine borers in piling. Professor George Delius and C. P. Tatro have secured a patent on this process.

A fender pile, which had been part of the dock for about a year, and had been almost eaten through by teredos, was hauled out of the water on to the dock and a careful inspection made, which showed it to be infested with live teredos. The pile was then lowered into the water again to a depth of about 12 ft. from the bottom. Four sets of wires with electrodes attached were lowered to the bottom, the electrodes resting on the mud, and an electric current of 200 amperes, 14 volts, was then turned on from a dynamo on the dock, for a period of six hours. The pile was then allowed to remain in the water three days to give the teredos every chance to recover life, when it was again hauled out of the water on to the dock. Portions of the pile were then cut out with an axe without showing any live teredos, and then a section of the pile was split through the center, revealing a perfect nest of teredos, but the borers, upon close examination, were all found to be dead. This demonstration was to show the method of applying this process to a dock which had never been treated before, but in subsequent treatments it would only be necessary to apply the current for one hour at intervals of about 30 days.

The principal wood borers which destroy piling and logs in salt water are commonly called teredos, and are worm-like mollosks, boring holes in the wood for a home. The tail is equipped with a bit-like end which cuts away the wood as more room is needed for the growth of the body. They are white, gelatine-like worms, smooth skinned and very easily crushed when exposed. Two small tubes in the head, which extend through the very small opening through the wood or bark into the water, provide sea water from which they get the infusoria on which they feed and oxygen to breathe. The water enters through one tube, passing to the tail and returns through the other tube, together with the wood borings, eggs and excrements from the body.

The destructive work of the teredo and other marine wood borers, and how to prevent the losses therefrom, has been a problem, the solution of which has engaged the attention and efforts of some of the best minds of the past several generations. Up to the present time all efforts seem to have been directed to enclosing the piling or other marine structure of wood in casings of various materials, such as cement, copper, iron and other materials, all of which are expensive and have proven entirely or partially inefficient; also a variety of chemical baths have been tried with only partial or indifferent success. In the latter class of baths, creosoting is the best up to the present, but its success is fully proven to be only temporary.

Aside from the excessive cost of the processes above referred to, it is found impossible to keep these coverings absolutely water-tight. When once the water gets in, the teredos will enter, as, when hatched, they are less than one-twentieth of an inch long and the size of a hair.

"Electrocution" by passing a high voltage through the piling has also been found worthless, as it does not kill the teredo, because he encases himself within a calcine lining of his hole, which is an insulator, and prevents the passage of the electric current to his body, besides being expensive as well as being attended with great danger of fire.

Treating the piling to a bath of hot creosote under great heat and pressure at a cost of about $28 per pile, has been found to preserve the piling an average of six to eight years only, against these attacks.

The process for protecting these pilings and other timber in salt water, is by the passing of an electric current of low voltage and high amperage in the immediate vicinity of the pile or other wood, but not in contact therewith, thus converting the salt contained in the water into its original parts, viz., chlorine and hydrogen gases, bromine, iodine and sodium-hydroxide, or concentrated lye. Of the elements liberated at the positive pole of the apparatus, chlorine gas is much the largest in volume.

Sixty per cent of salt is chlorine gas and one part by weight of chlorine gas in one-half million parts of water is sufficiently strong to destroy any of this order of marine life.

The plants of the Marine Wood Preservation Co. will comprise vessels with power producing machinery so placed as to operate dynamos for the electrolytic current (to liberate chlorine gas) and for self-propulsion from dock to dock and city to city.—*Railway and Marine News.*

RAIL RAVELINGS.

Pointers From the Old Man.

When you were a little tad and I a track foreman in a small yard, I had no idea that you would follow in my footsteps and make and maintain tracks, but such being the case, and you being appointed foreman of an important section prompts me to offer some of that freest of all free commodities—advice. You will find the duties of a "king snipe" many and varied, and you will also find many things to contend with, not the least of which will be the "rough necks" who have been braking anywhere from a few days to a few months, and think they know more about railroading than it is possible any track man will ever be able to learn. When you bump up against men like that, simply show them where to "head in," or see that they "back up," remembering that after a while they will begin to realize how little they actually know, after which you will get along with them all right.

You have taken charge of track work at the time of year (the winter season), when watchfulness is the keynote of the situation to a greater extent than at any other time of the year. The thorough-going track foreman is always on the alert for he understands that upon him depends not only the safety of the company's rolling stock and lives of its employes, but the safety and lives of the traveling public as well. We read of the eagle-eyed engineer with his hand on the throttle and his jaws firmly set, rushing through the night, carrying the lives of hundreds of passengers in his grasp. This is all very true, but the point I wish to impress upon you is this: The engineer is responsible for one train only, and when he reaches the end of his run and steps off of his engine, his responsibility ceases. But you, as section foreman, are responsible for the safety of every train that runs over your section in either direction and for every person who rides over it, including the above mentioned "brave engineer." And your responsibility does not end with the day's work, but continues whether you are present or absent, asleep or awake, just as long as you have charge of the track.

Few of the millions of people who travel by rail understand this or ever give a thought to the men who are constantly on the watch to see that the track over which they ride is at all times kept safe, and it will sometimes appear to you as you go along that the officials are as thoughtless and as little appreciative of your efforts as are the traveling public. Yet they know as do you that a little neglect on your part will derail their pet limited, or ditch any other train on the line. A switch point that for some reason fails to fit the stock rail closely, a guard rail that has become loosened, spikes broken off or bent back, allowing rails to spread, joint bolts loose enough to cause a "lip," any one of these and numerous other things small in themselves may cause a serious wreck. These things are more apt to occur when the weather is cold and stormy and some of them are harder to detect when the track is covered with snow.

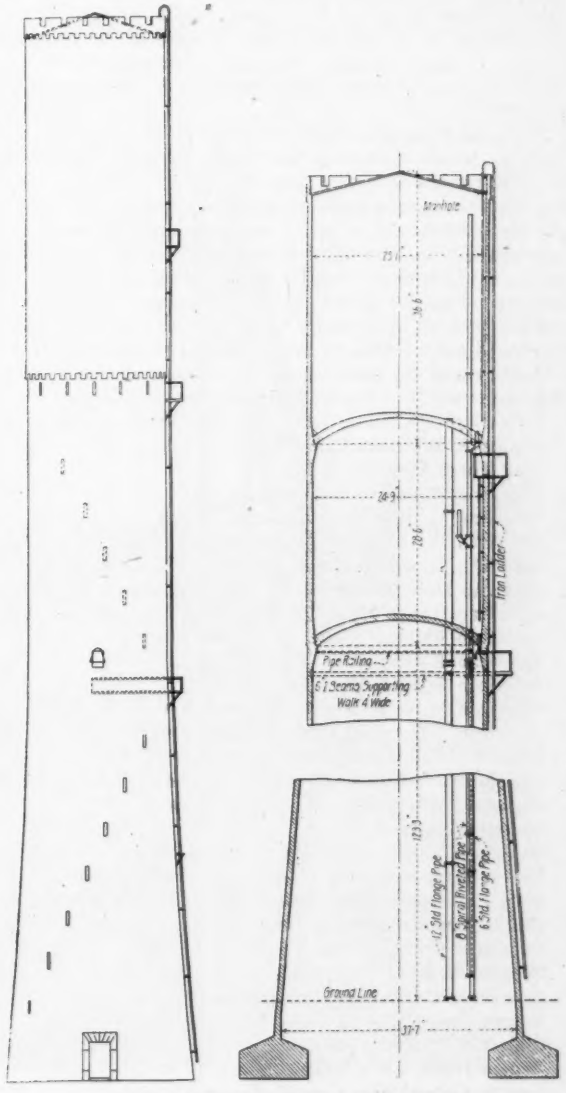
It is your first duty to thoroughly inspect the track and switches of which you have charge, every day, personally if possible. Have this inspection made by a competent man when not able to do it yourself. On track such as yours a reliable man should be put on as night track walker while the weather is cold. Unless you have changed from what you were when you used to "run" gangs for me and have got the big-head or "know-it-all" notion, and think the "old man" is a "back number," I will in my next discuss some of the phases of maintenance in winter.

REINFORCED CONCRETE WATER TANK.

The accompanying drawings show a design of tank recently built by the Central of Georgia, at Savannah, Ga. It rises 187 ft. 3 ins. from the ground line to the top of the parapet wall and 6 in. higher to the peak of the conical roof. The tank has a capacity of 150,000 gallons and consists of a chimney-like shaft 33 ft. 7 in. inside diameter at the ground line, tapering to an inside diameter of 24 ft. 7½ in. at a height of 66 ft. from the ground line, at which point the shaft assumes a cylindrical form, which is continued to the top.

The tank is double. There are two water storage compartments separated by dome shaped diaphragms which serve as bottoms for the tanks. The upper tank has a capacity of 100,000 gallons and the lower one 50,000 gallons. The upper tank is used for storage of water in case of fire on the terminals and the lower tank is for general use.

The tanks are supplied by electrically driven pumps and these are controlled automatically. In addition metal indicators are provided on the outside to show correctly the amount of water in the tanks.



Reinforced Concrete Double Water Tank.

When water was first turned into the tanks a considerable number of small leaks developed in the sides, evidently due to not using sufficient care in cutting the wires which held the forms together. These, however, rapidly took up and in a couple of months the tanks became entirely water-tight.

The concrete work was done by the Piedmont Construction Co., Atlanta, Ga. The entire work was carried out under the railway company's chief engineer, Mr. C. K. Lawrence.—*Engineer Contracting.*

With The Manufacturers

RAILWAY APPLIANCES ASSOCIATION.

The Railway Appliances Association will hold its fourth annual exhibit of railway construction, maintenance and operation appliances at the Coliseum, Chicago, March 18 to 23, inclusive, at the time of the annual convention of the American Railway Engineering Association. The exhibit will occupy not only the entire main floor, annex and balcony of the Coliseum, as in previous years, but also the First Regiment Armory, Michigan avenue and Sixteenth street, containing 16,000 sq. ft. of floor space, which will give a total of 54,000 sq. ft. of exhibit space. In spite of the additional amount of space available this year, practically all, or over 50,000 sq. ft., has already been reserved by the different exhibitors.

Many of those who have exhibited in former years have reserved larger spaces for the display of their exhibits this year, and there are many new exhibitors in the list, including several manufacturers of appliances pertaining more to the mechanical than to the construction or maintenance departments. On Tuesday of the week devoted to the exhibits, the American Railway Engineering Association will adjourn its session at 4 p. m. for the purpose of giving the railway men an opportunity to devote the remainder of the afternoon and evening to the inspection of the exhibits.

Applications for space should be made to Bruce V. Crandall, secretary, 537 South Dearborn street, Chicago.

Following is a list of exhibitors who have secured space:

Adams & Westlake Co., Chicago.
Ajax Forge Co., Chicago.
Alexander Crossing Co., Clinton, Ill.
American Casting Co., Birmingham, Ala.
American Concrete Pile & Pipe Co., Chicago.
American Guard Rail Fastener Co., Philadelphia, Pa.
American Hoist & Derrick Co., St. Paul, Minn.
American Iron & Steel Manufacturing Co., Lebanon, Pa.
American Railway Signal Co., Cleveland, O.
American Rolling Mill Co., Middletown, O.
American Steel & Wire Co., Chicago.
American Valve & Meter Co., Cincinnati, O.
American Vulcanized Fibre Co., Wilmington, Del.
American Well Works, Aurora, Ill.
Armspear Manufacturing Company, New York.
Asphalt Ready Roofing Co., New York.
Barrett Manufacturing Co., New York.
Bausch & Lomb Optical Co., Rochester, N. Y.
Beaver Dam Malleable Iron Co., Beaver Dam, Wis.
Blaw Collapsible Steel Centering Co., Pittsburgh, Pa.
Blocki-Brennan Refining Co., Chicago.
Boss Nut Co., Chicago.
Bossert Manufacturing Co., W. F., Utica, N. Y.
Bowser & Co., S. F., Fort Wayne, Ind.
Bryant Zinc Co., Chicago.
Buda Co., Harvey, Ill.
Buyers Index Co., Chicago.
Canton Culvert Co., Canton, O.
Carey Co., Philip, Cincinnati, O.
Carnegie Steel Co., Pittsburgh, Pa.
Carpenter & Co., George B., Chicago.
Chicago Bridge & Iron Works, Chicago.
Chicago Pneumatic Tool Co., Chicago.
Chicago Steel Tape Co., Chicago.
Cleveland Frog & Crossing Co., Cleveland, O.
Clyde Iron Works, Chicago.
Columbia Nut & Bolt Co., Inc., Bridgeport, Conn.
Concrete Form & Engine Co., Detroit, Mich.
Conley Frog & Switch Co., Memphis, Tenn.
Cook's Standard Tool Co., Kalamazoo, Mich.
Crane Co., Chicago.
D. & A. Post Mold Co. Three Rivers, Mich.
Des Moines Bridge & Iron Works, Des Moines, Ia.
Detroit Graphite Co., Chicago.
Dickinson, Inc., Paul, Chicago.
Dietzgen Co., Eugene, New York.
Dilworth, Porter & Co., Ltd., Pittsburgh, Pa.
Dixon Crucible Co., Joseph, Jersey City, N. J.
Drouve Co., G., Bridgeport, Conn.
Eastern Granite Roofing Co., New York.
Economy Spearable Switch Point Co., Inc., Louisville, Ky.
Edison, Inc., Thomas A., Orange, N. J.
Electric Railway Journal, New York.
Electric Storage Battery Co., Philadelphia, Pa.
Fairbanks, Morse & Co., Chicago.
Federal Cement Tile Co., Chicago.
Federal Signal Co., Albany, N. Y.
Foster, Frank M., Columbus, O.
Franklin Mfg. Co. of Pennsylvania, Franklin, Pa.
Fruit Growers' Refrigerating & Power Co., Anna, Ill.
General Electric Co., Schenectady, N. Y.
General Railway Signal Co., Rochester, N. Y.
Greenlee Bros. & Co., Rockford, Ill.
Grip Nut Co., Chicago.
Hall Signal Co., New York, N. Y.
Handlan-Buck Mfg. Co., Chicago.
Hart Steel Co., Elyria, O.
Hatfield Rail Joint Mfg. Co., New York.
Hayes Track Appliance Co., Richmond, Ind.
Hobart-Allfree Co., Chicago.
Hubbard & Co., Pittsburgh, Pa.
Indianapolis Switch & Frog Co., Springfield, O.
Ingalls-Shepard Forging Co., Chicago.
Inland Steel Co., Chicago.
Interlocking Nut & Bolt Co., Pittsburgh, Pa.
International Automatic Signal Co., Chicago.
International Steel Tie Co., Cleveland, O.
Johns-Manville Co., H. W., New York.
Jordan Co., O. F., Chicago.
Joyce-Cridland Co., Dayton, O.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.
Kerite Insulated Wire & Cable Co., New York.
Kernchen Co., Chicago.
Lackawanna Steel Co., Buffalo, N. Y.
Lebanon Engineering Co., Lebanon, Pa.
Lidgerwood Mfg. Co., Chicago.
Lorain Steel Co., Chicago.
Lufkin Rule Co., Saginaw, Mich.
Lupton's Sons Co., David, Philadelphia, Pa.
Lutz-Lockwood Mfg. Co., Aldene, Union Co., N. J.
Massey Co., C. F., Chicago.
Matthews & Rothermel, Chicago.
Milburn Co., Alexander, Baltimore, Md.
Moore & Sons Corp., Samuel L., Elizabeth, N. J.
Morden Frog & Crossing Works, Chicago.
Mudge & Co., Burton W., Chicago.
Nachod Signal Co., Philadelphia, Pa.
National Carbon Co., Cleveland, O.
National Lock Washer Co., Newark, N. J.
National Malleable Castings Co., Chicago.
National Roofing Co., Tonawanda, N. Y.
National Surface Guard Co., Chicago.
Nichols & Bro., George P., Chicago.
Northwestern Mfg. Co., Milwaukee, Wis.
Okonite Co., New York.

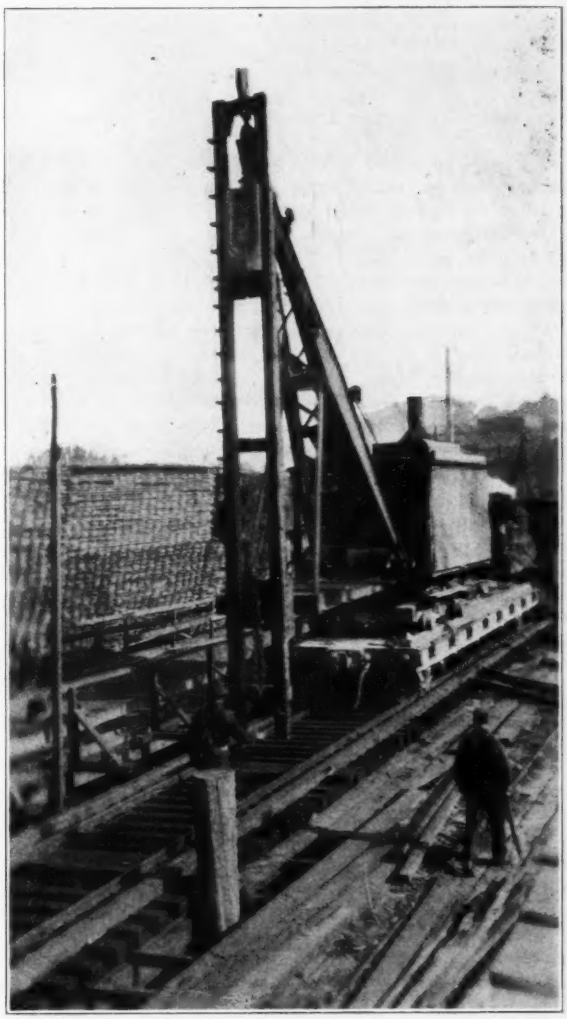
Spencer Otis Co., Chicago.
P. & M. Co., Chicago.
Patterson Co., W. W., Pittsburgh, Pa.
Pease Co., C. F., Chicago.
Pennsylvania Steel Co., Chicago.
Pittsburgh Steel Co., Pittsburgh, Pa.
Pocket List of Railway Officials, New York.
Potter-Winslow Co., Chicago.
Q. & C. Co., New York.
Rail Joint Co., New York.
Railroad Supply Co., Chicago.
Railway Age Gazette, New York.
Railway & Supplymen's Mutual Catalogue Co., Chicago.
Railway Engineering & Maintenance of Way, Chicago.
Railway List Co., Chicago.
Railway Review, Chicago.
Ramapo Iron Works, Hillburn, Rockland Co., N. Y.
Roberts & Schaefer Co., Chicago.
Sandwich Electric Co., Sandwich, Ill.
Scherzer Rolling Lift Bridge Co., Chicago.
Sellers Mfg. Co., Chicago.
Signal Engineer, Chicago.
Snow Construction Co., T. W., Chicago.
Standard Asphalt & Rubber Co., Chicago.
Standard Underground Cable Co., Pittsburgh, Pa.
Stark Rolling Mill Co., Canton, O.
Strait Scale Co., Chicago.
Strauss Bascule Bridge Co., Chicago.
Templeton, Kenly & Co., Ltd., Chicago.
Trussed Concrete Steel Co., Detroit, Mich.
Union Switch & Signal Co., Swissvale, Pa.
U. S. Wind Engine & Pump Co., Batavia, Ill.
Universal Concrete Tie Co., New Orleans, La.
Universal Metallic Tie Co., Salt Lake City, Utah.
Verona Tool Works, Chicago.
Weber Chimney Co., Chicago.
Weir & Craig Mfg. Co., Chicago.
Weir Frog Co., Cincinnati, O.
Whall & Co., C. H., Boston, Mass.
Wharton, William, Jr., & Co., Inc., Philadelphia, Pa.
Wilson Railway Gate Co., Birmingham, Mich.
Winans Improved Patent Rail Joint Co., Portland, Ore.
Winslow Co., Horace L., Chicago.

AUXILIARY USES OF THE "AMERICAN" RAILROAD DITCHER.

The "American" railroad ditcher is primarily a right-of-way ditcher, performing its work and loading the cars as it travels over the train on portable track sections, which it rapidly transfers from one car to another. The design is such that it is very adaptable and elastic in its application to a large number of auxiliary uses. The ditcher may be used as a pile driver, steam shovel, light wrecker, coal handler, locomotive crane, slide remover, clean-up train, log loader, rail loader and unloader, material, tie and timber handler, or clam shell and orange peel bucket handler.

On railroad operation of any extent it can be employed 365 days in the year. Flexibility of performance adds materially to its utility, and guarantees its value from an investment standpoint.

Many roads that have expensive, special pile driver equipment, use the pile driver attachment on their Americans for emergency work, when the ditcher is close by on other work, or the big driver is out of commission tied up. This attachment is perfectly adequate for everything except the heaviest work. Many of the smaller, as well as the larger roads, use this machine for all their pile driving; they save investment in regular pile driving equipment, and thereby



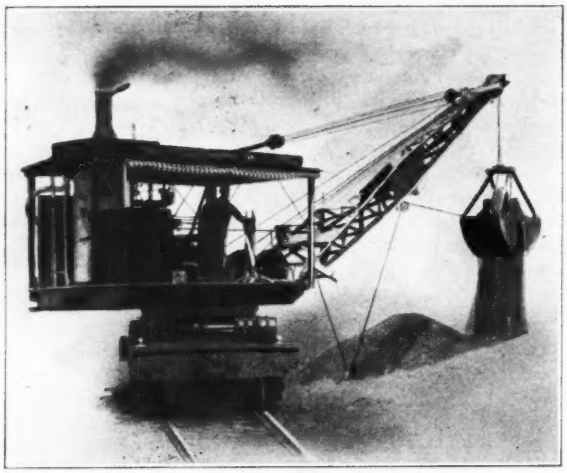
American Ditcher Driving Piles.

justify the purchase of a ditcher because of its many auxiliary uses, in addition to its use as a most efficient ditching machine.

The regular pile driver equipment includes a 1,500 lb. hammer with 30 ft. leads, providing for driving straight or batter piles at any point within a 40-ft. circle. Heavier hammer and longer leads can be used if desired.

The pull-back drum used in ditching or steam shovel work to pull the dipper back to point required, serves admirably in handling the line for spotting and lifting the piles to place. The regular hoisting drum used to raise the dipper

American Ditcher in Operation.



American Ditcher Operating Clam Shell Bucket.

in ditching and shovel work, handles the hammer. This attachment can be carried along with the machine and put on or taken off in a very short time.

The DeQueen & Eastern, DeQueen, Ark., reports driving 44 piles 16 ft. long and 10 in. in diameter at the small end, in 4 hrs. and 10 mins. through an 11-ft. penetration of gravel and gumbo, and through 4 in. of shale rock.

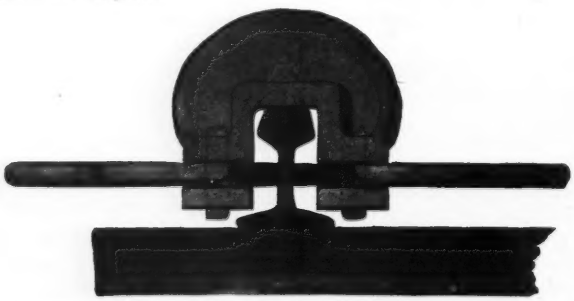
While a 1,500-lb. hammer is regularly furnished, the Bellingham Bay & British Columbia widened out their leads to accommodate 22-in. diameter piles and used a 2,200-lb. hammer for driving 50-ft. piling. This equipment was used exclusively in an extensive job of trestle work on Bellingham Bay, Wash., and it completely met the requirements. This railway has no pile drivers, but uses the ditcher pile driving equipment for all work of this kind.

Among upwards of 200 roads who use the American ditcher, the following use it either exclusively or partially for their pile driving: Chicago, Milwaukee & Puget Sound (2); North & South Carolina; Hampshire Southern; National Railways of Mexico (2); Raleigh & Southport; Kanawha & Michigan; Georgia & Florida; Apalachicola Northern; Mexico & Northwestern; Louisiana & Pine Bluff.

This machine easily handles a ¾-yd. clam shell, or 15 cu. ft. orange peel bucket, which adds another to its many valuable uses.

The Northern Pacific, having eight of these machines, has frequently used them to handle clam shell and orange peel buckets, for the purpose of cleaning out cinder pits, for coaling engines, and for digging sand from river beds for use in locomotives. A great many other railroads, when not ditching, have employed these machines for similar work with complete success.

The American Hoist & Derrick Co., St. Paul, Minn., manufactures the American railroad ditcher of which the above is a description; further information can be obtained from them on request.



B. & H. Rail Anchor in Position Over Rail.

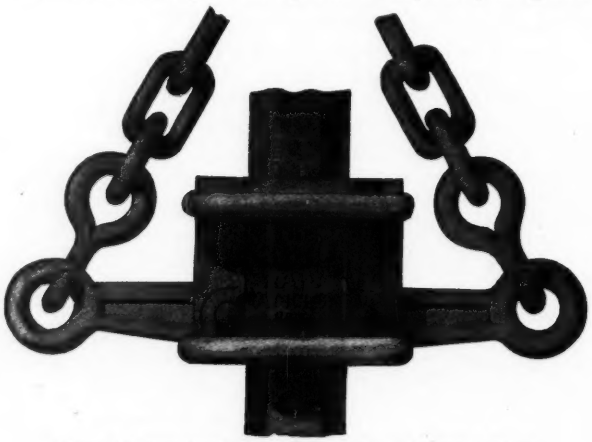
B. & H. RAIL ANCHOR.

We show herewith some illustrations detailing the construction and operation of the B. & H. rail anchor. This device can be used to anchor a wrecker, a track pile-driver, a steam shovel, or any other machine operating on rails.

The anchor has a heavy casting designed to make the side thrust developed when the anchor is in use. Before placing the anchor on the rails, the two lever arms are swung parallel to the track and the casting can then be placed astride the rail. When the arms are swung around nearly perpendicular to the rail, the inner lever ends contact against the web of the rail, which prevents further movements. The lever arms grip the rail tightly, and the anchoring power becomes greater as the strain increases.

A guy line is attached to the ring (not shown), which connects with the end link on the lever arm chains. The following advantages are claimed for the B. & H. rail anchor:

1. Instant application to rail.
2. Quick removal from rail.
3. Self-contained, no additional parts to assemble before rail anchor becomes operative or ready for use, eliminating any possiblity of lost parts.
4. No mechanical parts to adjust, such as gibs, wedges, keys, set screws, etc.
5. No skill required to apply or remove rail anchor from rail, thus avoiding any delay to train movements.
6. Does not require rail splices or stops to pull against.



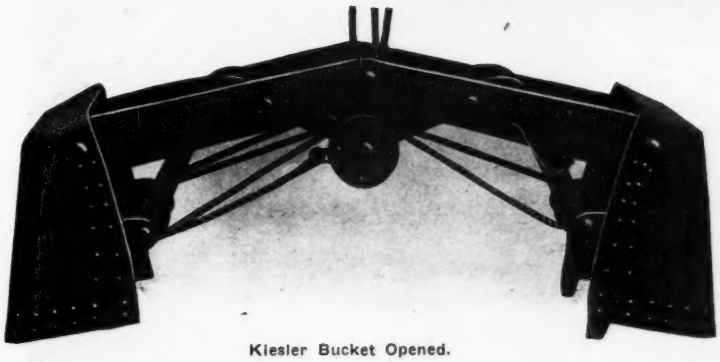
Plan Showing Chain Connections, B. & H. Rail Anchor.

7. Simplicity of design and few parts—a bracket, 2 lever arms, and 2 pins all in one.

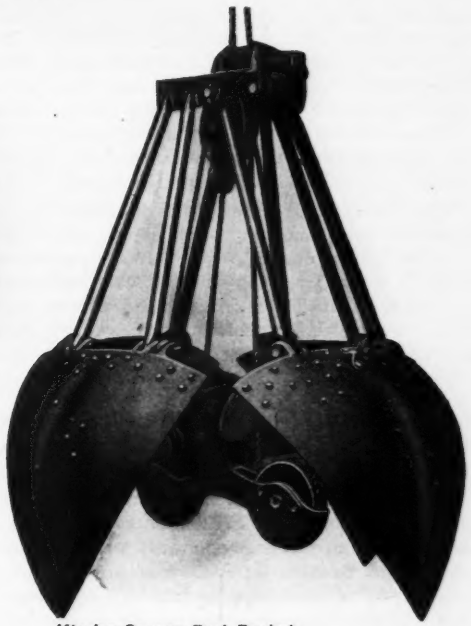
The B. & H. rail anchor is made by Prince-Groff Co., Camden, N. J.

KIESLER BUCKETS.

The Kiesler patent buckets of the orange peel, clam shell and scraper bucket types have a system of leverage that is a distinct departure from any other means of operating a bucket of this kind. They derive their power for closing from a powerful system of leverage developed in the closing mechanism, which actually forces the bucket into the material and causes it to fill itself. With the ordinary power-wheel or drum, the pull of the closing line reduces the effective digging power of the bucket, owing to the lifting action. Therefore it is not necessary to drop the Kiesler bucket on a pile of material to insure a full load. The Kiesler buckets are guaranteed to take more material for their specified capacity than any other bucket on the market of equal weight. The lever sheaves are completely guarded so that it is impossible for the material being handled to come in contact with the cable and the bucket can fall in any position and it will be impossible for the cable to jump off or chafe. The cable is so lead that there is very little



Kiesler Bucket Opened.



Kiesler Orange Peel Bucket.

wear, insuring long life, and when closing the power is applied to bell crank levers, producing a compound leverage on the blades which is strong, powerful and easily operated.

An important feature of the orange peel bucket is that it is constructed with eight vertical arms or connection rods (two on each blade) instead of only four as on other buckets. This makes the blades more rigid when digging into the material and closes the bucket tighter.

Another important feature of the clam shell bucket is that the center casting or head from which the bucket hangs is so constructed that the bucket will hang central under all conditions. This head is constructed with two ears or lugs so that when it is desirable to use the bucket in a different position it is only necessary to change the holding cable from one lug to the other and the bucket will take a position at right angles to its former position.

These buckets are manufactured by the Jos. F. Kiesler Co., 928 Pratt St., Chicago, Ill., and are being used very extensively and successfully for every variety of excavating and dredging.

Kiesler Clam Shell Bucket Closed.

New Literature

A catalogue entitled "Conduits" has just been issued by the H. B. Camp Co., of Chicago. It is artistic and dignified, and an excellent example of modern up-to-date catalogue work. A short description of the methods of manufacturing vitrified clay conduits, as carried on at the Aultman Ohio plants of the firm, is followed by a general discussion of the merits of vitrified conduits. The following pages are devoted to methods of inspection, specifications and cost tables. A chapter of particular interest to railway men is that on underground transmission for signalling, a system which is growing in favor each year. The booklet is well illustrated with excellent half tones, in which the Camp conduits are shown in their natural colors.

* * *

The McDonald Spiked Concrete Tie Co., Los Angeles, Cal., is sending out a small pamphlet showing a large number of illustrations of the process of making its patent reinforced concrete railway tie. The shape and method of reinforcing is shown plainly in several diagrams. Photographs are also shown of a number of installations of these ties in steam and street railways.

* * *

Greenlee Bros. & Co., Rockford, Ill., have issued a very attractive catalogue describing a number of machines for adzing and boring railway ties, and for driving screw spikes. The advantages, operation, and results obtained by the use of the adzing and boring machine are explained clearly and in detail, many good illustrations being shown in connection with the descriptions. The reading matter and illustrations are attractively arranged, and the catalogue is a credit to the company.

* * *

The Vixen Rail Planer is the title of bulletin A issued by the Vixen Tool Co., 5001 Lancaster Ave., Philadelphia. This device operates by hand and is designed to remove rail cor-

rugations, or to plane off battered or cupped joints. The booklet shows a detailed assembly drawing of the Vixen rail planer, very clearly showing its construction. Other illustrations are shown of special devices incorporated in the make-up of the machine. The pages each have a red border line, which combined with other features, gives the catalogue an air of distinctive individuality.

* * *

The General Fire Extinguisher Co., New York, has issued a bulletin describing the "Grinnell" automatic sprinkler. This is a fire fighting device for installation in structures. Illustrations of a number of buildings are shown, where these fire extinguishers have been installed. A number of letters published therein, tend to show the efficiency of the device, and the satisfaction of purchasers.

A PERMANENT RAILWAY SUPPLY EXHIBIT.

There has been established in the city of Chicago, in the Karpen Building, which is one of the largest and finest in that city, a permanent manufacturers' exhibit of railway supplies and equipment. The building is conveniently located on one of the principal boulevards and is very conveniently situated to the best hotels and also to several of the railway station. No expense has been spared to equip and maintain this very large enterprise which covers over twenty-six thousand square feet without partition or wall. It covers the entire twelfth floor, which is divided into one hundred and fifty booths the size and allotment of which is arranged in accordance with the requirements of the exhibitors.

It is proposed to make this a central headquarters for the display of all kinds of railway appliances where railway officers and men may examine samples and models of new devices and improvements.

In connection with the exposition is a large assembly hall which will seat over four hundred people. There is also provided committee and club rooms. The club features are to be the very best in furnishing and service that money can produce. Every convenience that can be thought of for the use of exhibitors and patrons has been installed. The exposition itself is most complete.

View of Booths, Manufacturers' Permanent Exposition of Railway Supplies.

The exhibitors are furnished with a complete outfit consisting of desk, table, chairs, rug, uniform sign, heat, light and janitor service. There are in the way of public utilities, long distance telephone and telegraph, public stenographer, etc. For the convenience of exhibitors, electricity, steam and water can be had for the operation of models.

Great care has been exercised by the management to see that nothing objectionable will be shown in the way of exhibits or literature. A very large number of the spaces have already been reserved and the success of the project is assured. A number of the booths are already occupied.

It is believed that the establishment of the permanent exhibition will fulfill an important function, enabling a railway man to inspect in a single visit the principal devices and appliances in which he is interested without the necessity of traveling to several different plants.

Extensions of the project will place maintenance of way exhibits exclusively on the second floor, leaving the present space for the exclusive use of exhibitors of mechanical department appliances.

The assembly and committee rooms will be placed at the disposal of both railway and supply men's organizations for their meetings, free of charge.

Karpen Building.

Industrial Notes

G. B. Jackson, Westminster, Md., manufacturer of railroad torpedoes, will rebuild the plant recently destroyed by fire. The new building and machinery will cost about $1,500.

The George M. Newhall Engineering Co. announces that its general offices are now located in the Morris building, 1421 Chestnut street, Philadelphia, Pa. The New York office of the company is at 50 Church street.

The Seattle, Rentoa & Southern Ry. has placed an order with the Westinghouse Electric & Manufacturing Co., for six double equipments of No. 317 motors with type HL, U. S. G. control.

The Universal Safety Tread Co., Boston, Mass., has moved its New York office from 50 Church street to 200 Fifth avenue, where larger floor space has been secured. This office is in charge of H. F. Stevenson.

Mr. F. M. Gilmore, formerly with the railroad department of the H. W. Johns-Manville Co., has accepted a position with the Chicago Car Heating Co., with headquarters in Railway Exchange building, Chicago.

The Tinsley Railway Supplies & Equipment Co., 1022 McCormick Bldg., Chicago, has been appointed exclusive rail-

road sales agent for "Nicine"—a disinfectant and deodorant made by the Hood Chemical Co. In this connection is announced the engagement of the services of Mr. C. T. Haigh, formerly of the Sherwin-Williams Paint Co.

The Spencer Otis Company, Chicago, has recently moved its main office to room 747 Railway Exchange building, Chicago, where a new feature has been introduced in the way of exhibiting several of the company's devices. The American Kron scale for railway work is exhibited in all sizes and capacities, The Au-Tra-Kar for boring holes and driving screw spikes is set up under power together with several other gasoline-propelled cars for railway work. The company will shortly open an office in San Francisco, Cal.

C. E. Knickerbocker, lately resigned as chief engineer of the New York, Ontario & Western, has gone to the Mac Donald Construction Co., New York, in charge of railway construction.

Mr. Chas. M. Lyle, for several years with Manning, Maxwell & Moore, in charge of their Southwestern territory, with headquarters in St. Louis, has resigned to accept the management of the St Louis Office of the Niles-Bement-Pond Co., whose offices are at 516 N. 3d St.

The Isthmian Canal Commission will receive bids until January 24 on cast iron car wheels, and until January 25 on automatic signal material, for the relocated line of the Panama R. R.

Announcement has been made of the reorganization of Watson-Stillman Co., manufacturers of hydraulic machinery, with a plant at Aldine, N. J., and general offices at 50 Church street, New York. It is stated that the increasing use of hydraulic presses and the steady growth of the business necessitate an immediate extension of the company's manufacturing facilities.

The West Penn has increased its equipment by an order of 302 electric motors, ordered from the Westinghouse Electric & Manufacturing Co.

The Independent Pneumatic Tool Co., Chicago, has recently placed on the market a new One Man drill, which is equipped with compound planetary gears, and is particularly adapted for drilling, tapping and screwing in staybolts and studs of all sizes up to 1¼ in. This drill is of the reversible type, weighs 20 lbs. equipped with No. 3 Morse taper socket, and has Corliss valves.

The American Locomotive Co., New York, has received an order from the Copper River & North Western for one rotary snow plow with 18 in. x 26 in. cylinders, for a 12 ft. 6 in. cut.

At the meeting of the Board of Directors of the Galena Signal Oil Co., the following officers were elected for the ensuing year. General Charles Miller, chairman of the board; S. A. Megeath, president and general manager; C. C. Steinbrenner, vice-president; E. H. Baker, second vice-president; E. H. Sibley, treasurer; J. French Miller, secretary; G. F. Proudfoot, assistant secretary.

The Western Steel Car & Foundry Co., will exercise its option for purchase of Illinois Car Equipment Co. at Hegewich, for $1,100,000.

A railway supply salesman with ten (10) years' experience would like to represent manufacturers in Chicago and the West. References. Address W. C., care Railway List Co., 431 So. Dearborn St., Chicago.

The United Car Co., with offices in the Commercial National Bank building, Chicago, which has recently been organized, has purchased the entire plant and equipment of the American Car & Equipment Co., Chicago Heights, Ill., including a large erecting shop, blacksmith shop, offices, etc. It will build and rebuild cars and handle railway supplies in general, making a specialty of steel underframes and tank cars. C. H. Thomas is president of the company.

RAILWAY CONSTRUCTION.

The Chicago, Burlington & Quincy has had engineers in the field for several weeks running a line for a cross-country line to connect the St. Louis terminals of the road at West Alton with the Burlington coal line in Southern Illinois. The plans for the improvement are understood to call for a new steel bridge over the Mississippi river at Alton, Ill., and an extension of its system southeasterly by a cross-country line from Alton.

Engineers of the Chicago, Burlington & Quincy are reported to have surveys under way at Ulm, Wyo., for the new location of the main line and passing tracks at that place.

The Chicago, Rock Island & Pacific is said to be considering the construction of a cut-off from Fairbury, Nebr., to Clay Center, shortening the line from Omaha and McFarland 110 miles.

According to advices from Omaha, Neb., plans for the construction of two viaducts in that city during the year of 1912 have been completed. One is the Nicholas St. viaduct, to be built by the Missouri Pacific and the Omaha Railroads. The other is the viaduct on Bancroft St. to be erected by the Union Pacific, the Great Western and the Burlington.

The Missouri, Arkansas & Gulf has given a contract to E. E. Young & Co., Rolla, Mo., to build from Rolla south to Bakersfield, 125 miles. Maximum grades will be 1½ per cent, maximum curvature 6 deg.

Board of Public Works, Marion, Ind., has instructed the Pennsylvania to erect a bridge over the tracks at Western Ave. and to grade and improve the north approach.

Work will be started at once on the depot track for the Macon & Birmingham at Macon, Ga.

The Missouri, Oklahoma & Gulf, according to reports, has taken out a new charter in Oklahoma to build the extension from Henrietta, Okla., west to Oklahoma City, 102 miles.

The Northern Pacific is understood to be about ready to let contracts for work on its Point Defiance, Wash., line. This will include a tunnel about one mile long from a point near the smelter at Rustin, and the construction of a roadbed along the shore of Puget Sound from the Narrows to Nisqually River and thence to Tenino.

The Salt Lake & Ogden is double tracking its road from Lagoon to Kaysville, a distance of 4½ miles.

The contract for grading on the Colusa and Hamilton City branch of the Southern Pacific has been awarded to J. F. Mallon, Princeton, Cal.

The Statesville Air Line has finished grading on about eight miles between Statesville, N. C., and Mt. Airy. Maximum grade will be 1½ per cent, maximum curvature 6 deg. There will be five steel bridges, of a total length of 700 ft., and seven small trestles.

The Wilson Northern has completed ballasting the entire roadbed and put same in first-class condition.

The Winnipeg, Salina & Gulf has been granted authority in Kansas to issue bonds for building 1,080 miles of railway. The plans call for the construction of a north and south line from Winnipeg, Can., to the Gulf of Mexico, with a cross line from Kansas City, Mo., to Des Moines, N. M. H. L. Miller, Salina, Kans., president.

The new office building to be erected by the St. Louis & San Francisco at Joplin, Mo., is to occupy an area of 100 ft. x 127 ft., will be eight stories in height, and will cost about $350,000. It is to contain a passenger station, storeroom and offices.

The Oregon-Washington R. R. & Navigation Co. will soon ask for bids for the construction of the proposed bridge crossing the river above the Monroe street bridge, Spokane, Wash.

It is reported that the Southern Pacific will soon start work on a freight station at Nogales, Ariz.

Recent Engineering and Maintenance of Way Patents

CATTLE GUARD.

1,014,696—Robert J. Dillon, Killaloe, Ont.

A cattle guard comprising a frame adopted to rest between the rails, slats located therein provided with inclined surfaces and smooth rollers located above and parallel with the slats adapted to precipitate the feet of the cattle upon the inclined surfaces of said slats.

RAILWAY ROAD BED.

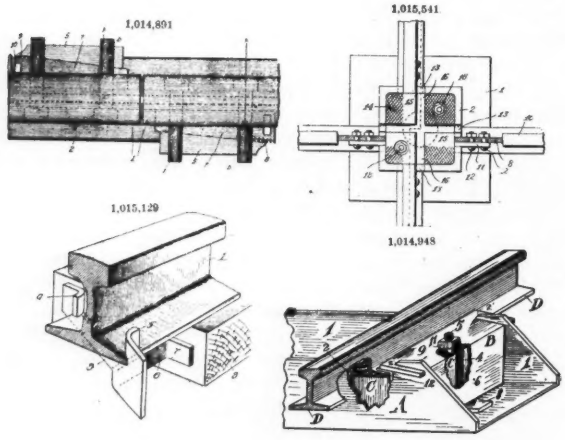
1,014,700—John W. Gibson, Muncie, Ind.

The roadbed herein described has a transversely convexed surface terminating in shoulders extending longitudinally of the track; rails extend along the shoulders and asphalt fillings is interposed between the rails and the roadbed; a metallic plate transversely curved rests between the rails and the asphalt. There is cushion asphalt between the plates and the asphalt bed, tie rods connecting the rails, wedges interposed between the shoulders and the rails for adjusting the rails, asphalt filling between the edges of the two plates and between the edges of the base flanges of the rails on which the tie rods rest, and an asphalt filling between the two rails covering the tie rods.

RAIL FASTENER.

1,014,891—Manuel G. Medeiros, Irvington, Cal.

A device comprising unthreaded bolts provided with longitudinal slots, two wedge shaped keys adapted to project through the slots and engage each other, teeth on the side of one of the keys at one end, and a lug projecting horzontally from one end of the



other key and adapted to be bent into an engagement with the teeth, the key with the teeth is provided with a transverse slot in its end which is provided with the teeth, the slot being adapted to receive an instrument adapted to pull the key to disengage the teeth from the lug.

RAILWAY TIE AND FASTENER.

1,014,948—John T. Clark, Provo, Utah.

This patent relates to the combination of a metal channel having rail receiving cuts in the sides and cross-shaped slots in the bottom; short blocks of hydrocarbon cementitious concrete closely fitted within the channel and having vertical channels in the sides thereof; clamp plates, one portion thereof being adapted to fit transversely within the channel, and one portion to engage the flanges of the rails, and vertically placed bolts adapted to engage within the cross-shaped slots in the bottom of the metal channel and the channels in the blocks and adopted to hold the clamp plates in place.

RAILWAY SIGNAL FUSEE.

1,015,062—Isadore Niditch, Dorchester, Mass.

A signal fusee comprising a tube, a signal compound therein, a lighting stratum at one end of the fusee and a wood peg saturated with a combustible compound, the outer end of the wood peg united with the lighting stratum and its inner end united to the signal compound whereby the peg binds the lighting stratum to the signal compound and conveys the fire from the lighting stratum to the signal compound.

JOINT SUPPORT.

1,015,102—James P. Vaught, Kellerman, Ala.

A saddle bar formed at its ends with upstanding bosses, a bridge bar disposed at its ends upon the saddle bar with its end edges seating against the bosses, and securing elements inserted through the ends of the saddle and bridge bars. Also a rail chair having a rail engaging portion and a base extending beneath the bridge bar, and securing elements inserted through the bridge bar and the base of the rail chair.

RAIL ANCHOR.

1,015,129—John A. Bodkin, New York, N. Y.

The rail anchor herein described comprises a yoke, rail-engaging members and a post all cut out of a sheet of steel, the post being bent at an angle to the yoke, and the free end of the post being bent laterally to form a foot for engaging with a tie.

RAILWAY CROSSING.

1,015,151—Berman S. Dunham, Detroit, Mich.

This patent consists of a railway crossing comprising a track composed of a pair of traffic rails extending continuously and unbroken throughout the crossing, a pair of rigid rails constituting an interesting track divided into sections to provide for transit over the first track, movable rails hingedly connected to the divided rails with their bearing surfaces above the horizontal plane of the bearing surface of the first named track whereby the wear of either track is dependent only upon its own respective use. An easing rail is connected to each of the rigid rail sections and projects longitudinally beyond the sections, the movable rail sections being adapted to engage the projecting portions of the easing rails when the rigid and movable rails are shifted into alignment. Means are provided for operating the movable rails.

REVERSIBLE SWITCH FROG.

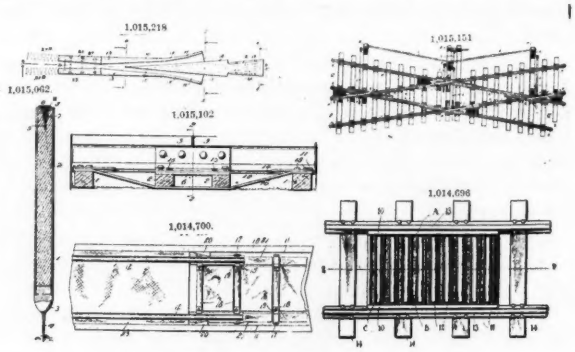
1,015,218—Otto Swanson, Chicago, Ill.

A reversible railway frog consisting of a plate having on each of its faces and at each edge thereof a guard rail and provided on each of its faces with a frog-point extended between the guard rails and projected beyond one end of the plate, the plate having at its other end a horizontally disposed extension provided with a flange at each of its edges, and rail sections having grooves on their inner surfaces to receive and secure the flanges on the extension.

RAILWAY CROSSING.

1,015,541—C. H. Christian, Atlanta, Ga.

A railway crossing comprising a base-plate, a seat-box integral with the base-plate provided with a central opening in its bottom and having openings in its side-walls, a flange-block fitted in the



seat-box provided with rail-treads on its upper surface, a stud projecting from the under side of the flange-block and fitting in the central opening in the bottom of the seat-box, rails resting at their ends on the base-plate forming with the rail-treads on the flange-block continuous tracks through the openings in the side-walls of the seat-box, and means for securing the ends of the rails in place.

The Northern Pacific is asking for bids for a new passenger station, to be built at Winlock, Wash., to replace the structure recently destroyed by fire.

The Oregon-Washington Railroad & Navigation Company has given a contract to Grant, Smith & Co., Seattle, for the erection of a machine shop 90 ft. x 180 ft., a power house 40 ft. x 90 ft., and a storehouse 36 ft. x 36 ft., all of reinforced concrete construction.

Plans are being made by the Panama R. R. for building a new passenger station at Panama City. It is said that the new building will be of reinforced concrete construction, two or three stories high, and will have concrete platforms and train sheds.

The Pennsylvania R. R. has given a contract to the J. S. Rogers Company, Morristown, N. J., for building a passenger station at Summit and Sip avenues, Jersey City, N. J., to cost about $76,000.

The Pennsylvania is having plans prepared for a concrete pier, 150 x 600 ft., which will be erected at Christian street wharf, Philadelphia.

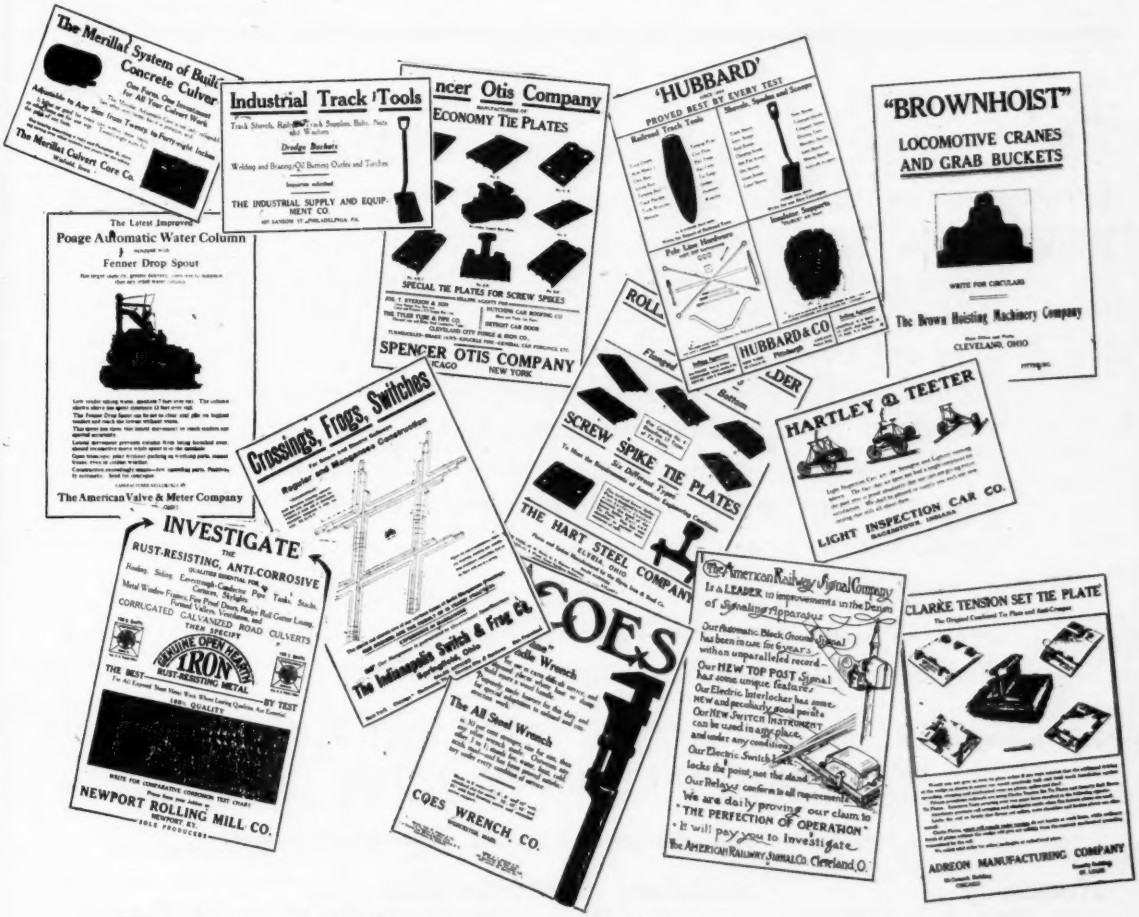
The St. Louis, Iron Mountain & Southern will build a 30-stall roundhouse at Argenta, Ark.

The Only Paper Devoted Exclusively to

RAILWAY ENGINEERING AND MAINTENANCE OF WAY

Railway Engineering and Track

The Twin Specials March **and** ***April*** **1912, will be bound together and distributed among Railway Engineering Officials for their libraries. Advertisements in these two issues will be especially productive of results because:**



These ads ran in the 1911 Specials. Place your ad with us this year and get in good company.

(1) They will be seen by our readers in the current numbers and in addition,

(2) They will get the benefit of an extra distribution at the convention, and furthermore,

(3) They will be preserved in the bound edition which will be a reference work, as it will contain the full convention report in *one volume*.

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THE RAILWAY LIST COMPANY

Manhattan Bldg., Chicago

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